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VOL. 39 JANUARY, 1937 No. 1

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ENTOMOLOGICAL SOCIETY

OF WASHINGTON

CONTENTS

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OFFICERS FOR THE YEAR 1937.

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PROCEEDINGS OF THE

Entomological Society of Washington

VOL. 39 JANUARY, 1937 No. 1

ON THE OVIPOSITION HABITS OF STILBULA CYNIPIFORMIS ROSSI (HYMEN., EUCHARIDAE).

By H. L. Parker,

European Parasite Laboratory, Division of Foreign Parasite Introduction, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

In 1921, W. R. Thompson *en passant* discovered the presence of a number of adult *Stilbula cynipiformis* on bushes and weeds in a small plain on the banks of the Gapeau River, near Montrieux (Var), France. At Dr. Thompson's instigation the writer returned to this spot during the following years to look for these adults and to discover, if possible, something anent their biology.

It was found that this species passes its larval stage as a parasite in cocoons of the ant *Camponotus aethiops* (Ent. News, XLIII, No. 1, p. 1, Jan., 1932). It was not known where or how oviposition took place and this was discovered in the following manner: In 1935, Mr. C. P. Clausen, who has published several articles on the manner of oviposition of various interesting species of parasitic Hymenoptera, advised us that the method of procedure to discover this was to spot a flying female and follow her to her destination. Accordingly, at the next opportunity (August 12, 1936), we betook ourselves to the spot where the adults were known to occur and, surely enough, we soon observed a female flying by. It was easy to follow her and we observed that she alighted on the fruit pods of a small composite plant, *Picris hieracioides* L. var. *spinulosa* Gussone. There was another female already on this plant apparently dead in place at the termination of oviposition. A quick survey soon brought to light other scattered plants of this rather uncommon species and on most of them were live females ovipositing and many females dead in place and stuck fast to the outer surface of the pod after the termination of oviposition.

To oviposit, the female takes a vertical position on the side of the fruit pod, holding on with her feet, her head directed upwards; she then lifts her abdomen, places the point on the bracts, and thrusts the ovipositor into the fruit pod between or through the bracts. She remains in this position apparently

until all her eggs are laid or at least a big mass of them and, as we said before, often dies with her ovipositor still inserted into the fruit pod of the host plant.

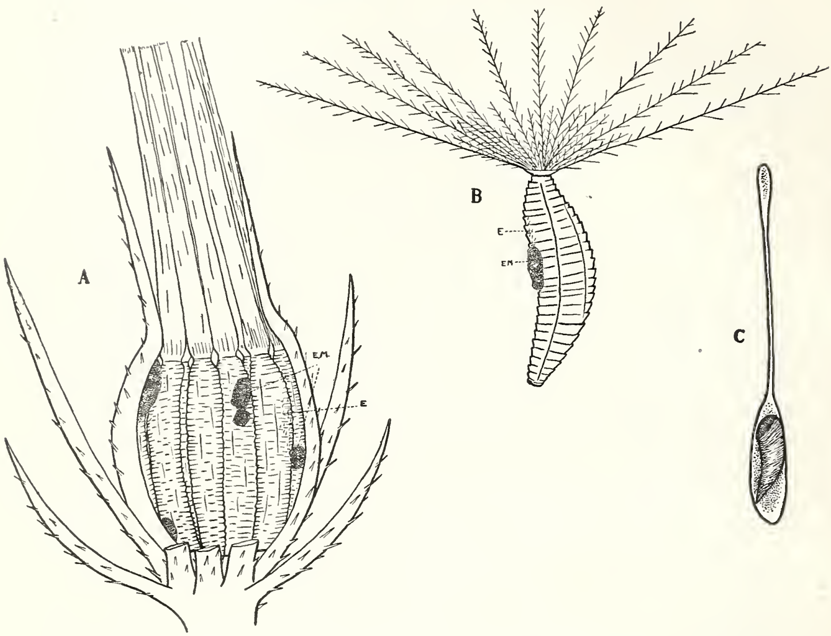


Fig. 1.—A, a fruit pod of *Picris hieracioides* L. var. *spinulosa* Gussone with some of the outer bracts removed to show egg bundles of *Stilbula cynipiformis* Rossi. *E. M.*, egg masses; *E*, individual scattered eggs (the individual eggs are not drawn to scale); B, a seed of *P. hieracioides* var. *spinulosa* after discharge from the capitule, bearing a mass of eggs of S. *cynipiformis;* C, an egg of *S. cynipiformis* showing the fully developed larva inside. Age of egg about 2–3 weeks.

The eggs are laid in enormous "bundles" of several thousands under the bracts of the fruit pod (Fig. A), some masses clinging to the bracts of the pod, others to the outer layer of seeds. Sometimes in the vicinity of an egg "bundle" there are a few scattered eggs attached to a seed or seeds.

The egg (Fig. C) is of the stalked form characteristic of the family, and, in those in which incubation is complete, the highly pigmented larva lies with its head at the base of the stalk. The stalk is approximately twice the length of the egg body.

The stalks of the eggs seem to be intertwined around one another in the middle of the bundle so that the bundle is held together by this method. We surmise that a single one of the

larger bundles is the entire oviposition product of a single female; it is not impossible that such a bundle contains 10,000–15,000 eggs.

A number of these fruit pods were brought in to the laboratory for observation. As the pods opened up a few days later, it was observed that some of the whitish egg masses had changed to a dark blue color. Each egg, when examined under the microscope, was observed to contain a fully developed larva. As the fruit pod opens and the circular plumes on each seed deploy and bear the seed away, some egg masses cling to a seed (Fig. B) and some remain attached to the inner surface of the bracts. It is not unlikely that those which are carried away by the seeds are eventually taken by the ants into their nests, where the larvae hatch out and parasitize the ant larvae or pupae.

No eggs have hatched up to the present writing (September 10, 1936); on the contrary, a number of the masses have apparently dried up completely, at all events the eggs on the periphery of the bundle have done so.

A further visit to the same spot on September 3, revealed that there were freshly deposited eggs in some of the later-ripening heads of *Picris* while the older heads from whence the seeds had gone still bore many bundles of apparently dried-up eggs.

ATAENIUS CHAPINI, SP. N., FROM MEXICO (COLEOPTERA, SCARABAEIDAE).

By Howard Everest Hinton,
Zoological Laboratory, Cambridge, England.

While checking through the published descriptions of the species with a view to a revision at a much later date, I have at one time or another occasion to examine nearly all the descriptions published to date of the American species of *Ataenius* and have found no description (including my own earlier descriptions) which is really satisfactory. All are too brief, and in no case are they accompanied by figures of the male genitalia, though in a few instances, Fall (1930), the general form of this structure is mentioned. While engaged in the exasperating business of puzzling over the descriptions of the usual too laconic systematist, I have been able to make a list of the more important specific characters which apply to one species or another of this large genus and have thought that the presentation of such a list might have a small part in ridding future describers of *Ataenius* of their taciturnity. In the genus *Ataenius* a description of the exact distribution of the punctures of various sclerites is often essential, and vague statements such as "punctures moderately dense at sides" are definitely inadequate.

The reader does not know what Mr. Roe's idea of dense is and whether or not it is concordant with Mr. Doe's idea of dense. It is just as easy and much more accurate to say, "punctures at sides separated by two times their diameters." The same criticism also applies to words such as punctures fine, punctures dense, and so on which are not further qualified. It is best to either measure one group of punctures or compare their diameters with that of a specifically stable structure so that the diameters of other punctures on the body can be accurately expressed by comparisons with the measured group.

A list of the characters which are of specific value in one or another of the species of *Ataenius* follows:

1. Breadth and depth of clypeal emargination.
2. Length of middle of deflexed portion of clypeus. This character has not been properly described before but is likely to prove of great value, as striking and constant differences have been noted between species, e. g., *limbatus* Bates and *figurator* Har.
3. Condition of angles on each side of emargination, whether rounded, angled or toothed.
4. Condition and extent of clypeal suture.
5. Sides before genae, arcuate or straight, etc.
6. Genae prominent or otherwise and whether rounded, obtuse, rectangular, or acute.
7. Head evenly convex or horned.
8. Head either smooth, punctate, or rugose or with a combination of all three. The sculpturing of the surface should be described very carefully, as certain species can only be distinguished by the most minute and yet constant differences here. A statement as to the presence or absence, and if present, of the condition of the usual belt of coarser punctures at base of head is important.
9. The general length and breadth of the thorax should be given.
10. Sides and base should be described as to general outline, i. e., whether arcuate or nearly straight, etc., distinctness and depth of marginal line and whether or not the margin is fringed with setae.
11. The apical and basal angles should be described, the basal ones particularly carefully.
12. Pronotum whether with a median impression, e. g., *gracilis* (Melsh.), or evenly convex, or with a somewhat explanate area near anterior angles, e. g., *egulyptus* Bates.
13. Length and breadth of elytra.
14. Condition of humeri whether dentate, and if so acutely or obtusely, etc.
15. Intervals of elytra as to convexity, scoring along sides as in *capitosus* Har., punctation on disk and at sides and apex.
16. Striae as regards breadth to breadth of intervals, type and depth of punctation and whether or not the punctures crenate sides of intervals, and if so how coarsely.
17. Scutellum is often impressed, e. g., in *scutellaris* Har. but is more often smooth.

18. On the front leg the punctation of the posterior face of the femora and the length of the first tarsal segment should be described.
19. On the middle leg the length of the femoral marginal line, punctation of femora, presence or absence of accessory spinule, and if this last is present, its proximity to the shorter spur and whether or not a spinule of the terminal fringe intervenes between it and the shorter spur are all important characters to be considered in the description.
20. On the hind leg attention must be paid to all the points enumerated for the middle leg, and, in addition, the relative length of the first tarsal segment to the longer spur and to the remainder of the leg should be given.
21. Punctation of mesosternum and carina between middle coxae.
22. Punctation of the disk and sides of the metasternum. Occasionally, as in *strigicauda* Bates, the disk will have a localized group of coarse punctures which are a valuable specific character.
23. The punctation of the abdomen is important.
24. And, perhaps needless to add, the general form, vestiture, lustre, convexity, and length and breadth should be described.

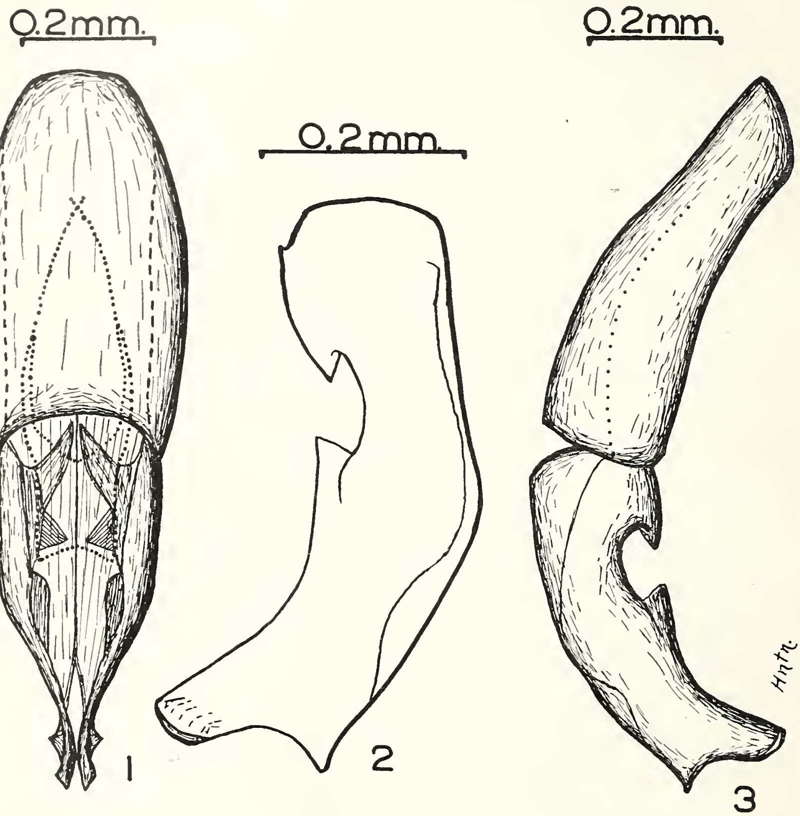
This list is a minimum of the characters which should be considered in describing a new species, and yet few existing descriptions contain them all.

Ataenius chapini Hinton, sp. n.

(Text figs. 1–3.)

Male.—Length, 4 mm ; breadth, 1.6 mm. Subparallel, moderately convex. Dorsal surface nearly glabrous but with a few sparse setae (scarcely visible under a magnification of times 144) at apex and extreme sides of elytra and a few moderately short, stout setae forming an irregular fringe (setae in my specimens appear to have been badly rubbed) at sides and base of prothorax. Cuticle shining; on dorsal surface feebly, microscopically alutaceous only on head and sides and apex of elytra; piceous to dark rufo-piceous; antennae, mouthparts and legs slightly paler. *Head* moderately convex, not horned; clypeal suture traceable at sides to middle half of head; clypeus broadly moderately deeply emarginate with the length of the deflexed portion at middle of front slightly longer than the diameter of the basal segment of the hind tarsus; sides of the emargination broadly rounded; sides before genae feebly arcuate; genae obtusely rounded, moderately prominent. Surface with feeble, transverse rugae on anterior one-half at middle and anterior two-thirds at sides, these rugae becoming slightly denser and more prominent anteriorly; with a belt of punctures behind clypeal suture which vary from .014 to .010 mm. in diameter and are usually separated by three-fourths to one and one-half times their diameters, these punctures being slightly sparser at middle; anterior to this belt the punctures are slightly finer and sparser to rugose portion. *Prothorax* evenly and moderately strongly convex; at broadest point near basal one-third broader than long (1.475 mm. : 1.025 mm.); sides moderately arcuate, feebly converging towards apex, deeply and distinctly margined; base scarcely noticeably bisinuate, deeply and distinctly margined; apical angles obtusely rounded, basal angles broadly truncate but with the angle on each side of the truncation broadly rounded. Surface of pronotum with two sizes of punctures distributed

as follows: fine punctures about as fine as those of head and usually separated by two to five times their diameters, slightly more numerous on anterior portion of disk and absent at sides; coarse punctures generally .030 mm. to .480 mm. in



Figs. 1 to 3.

(1) Dorsal view of the male genitalia of *A. chapini* Hntn. (2) Lateral view of paramere of the same dissected off. (3) Lateral view of the whole genitalia of the same.

diameter though occasionally as small as .015 mm., at sides separated by less than half their diameters and sometimes confluent, towards middle of disk they become sparser and at middle they are present only on basal two-fifths where they are separated by slightly less than to two or more times their diameters. *Elytra* twice as long as prothorax (2.4 mm. : 1.02 mm.), about as broad at base as base of prothorax, about one-third longer than greatest breadth at one-half (2.4 mm. : 1.6 mm.) and at humeri narrower than at one-half (1.4

mm. : 1.6 mm.). Humeri moderately feebly dentate. Intervals feebly convex, at apex and sides more strongly convex, discal intervals broader than sutural intervals (.120 mm. : .084 mm.); surface with the punctures as fine as finest of head and separated by three to ten or more times their diameters, at sides and apex punctures which are generally about twice as coarse are usually on sides of intervals and are usually separated by less than to three times their diameters. Striae one-seventh as broad as sutural interval; discal strial punctures are usually oval and are generally separated by one and one-half to two times their diameters, these punctures coarsely but shallowly crenating sides of intervals. *Mesosternum* as usual in the genus confluently punctate; carina between coxae short, broad and moderately convex. Metasternal disk with the median impression broad and deep; surface of disk with the punctures similar to those of basal portion of head and varying in size to the same extent, irregularly distributed but usually separated by three to five times their diameters; extreme sides densely, microscopically alutaceous and with traces of confluent punctures which are about as coarse as coarser punctures of pronotum, anteriorly and nearer disk these punctures become less confluent and separated up to one-half of their diameters; at sides of disk a single row extends nearly to posterior margin. Abdomen entirely punctate, those punctures on the middle being slightly finer than those at sides of metasternum and separated by less than to two times their diameters; towards sides these punctures become coarser and denser and at sides they are slightly coarser than those of sides of metasternum and are occasionally confluent to separated by about one times their diameters. Front leg with the first segment of the tarsus nearly as long as the combined length of the following two segments (.096 mm. : .108 mm.); posterior face of femora with about 20 finely setose punctures which vary from .036 mm. to .024 mm. and are occasionally confluent to separated by twice their diameters, anterior one-third to two-thirds free of these punctures but with a few punctures as fine as those of head. Middle femora with the marginal line present on apical three-fourths; punctate similarly to anterior portion of posterior face of front femora and near apex with a few shallow punctures which are about as coarse as coarse pronotal ones; tibiae with the accessory spinule prominent, closely adjacent to shorter spur and without intervening spinule of terminal fringe. Hind femora with the marginal line present on apical one-half; punctate as middle femora; tibiae with the accessory spinule similar to that of middle femora; first tarsal segment slightly longer than longer spur and very slightly shorter than the combined length of the four following segments. Genitalia as figured (text-figs., 1–3).

Female unknown.

Type.—A male in the author's collection. Mexico: Dist. de Temascaltepec, Tejupilco, alt. 4,000 ft., VI–1933 (*H. E. Hinton, R. L. Usinger*).

Paratypes.—One male in the collection of the United States National Museum and five males in the collection of the writer with the same data as the type.

Variations.—No variations worthy of mention have been noted.

Comparative Notes.

On external characters I can not separate this species from *A. cribrithorax* or any of the latter's closely allied relatives, but the structure of the male genitalia differs strikingly from all other known species in the group. Considering the genitalia alone, it appears to be most closely related to *A. communis* Hntn. and *A. panamensis* Hntn. There are probably females of this species before me, and if so, I can not separate them from the females of closely allied species occurring in the same region.

I take great pleasure in dedicating this species to Dr. E. A. Chapin who has helped me through the loan of material since I first became interested in this group of the Scarabaeidae.

CONSTITUTION AND BY-LAWS OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

Ratified at the annual meeting, December 3, 1936.

CONSTITUTION.

Article I—*Name.*

The name of this organization shall be The Entomological Society of Washington.

Article II—*Objects.*

The objects of the Society shall be to promote the study of Entomology in all of its bearings, to publish a periodical to be known as the Proceedings of the Entomological Society of Washington, which shall contain the proceedings of the Society and such papers as are accepted for publication, and to cultivate mutually advantageous relations among those in any way interested in entomology. To further these objectives dues shall be collected from the members.

Article III—*Members.*

Section 1. Members shall be persons over eighteen years of age who have an interest in the science of Entomology. Any person who has been a member of the Society for five years and who has paid up his or her dues may become a Life Member by paying $40.00. Any member who has paid up his or her dues may become a Sustaining Member at any time by paying $100.00. Life and Sustaining Members are exempt from paying further dues.

Section 2. Candidates for membership may be proposed to the Executive Committee in writing, with the indorsement of two members in good standing. The recommendation of the

Executive Committee and an affirmative vote of two-thirds of the members present at a regular meeting of the Society shall be required to elect.

Section 3. Each member shall be entitled to one copy of each issue of the periodical published by the Society and shall be privileged to vote on all questions. Members shall be given preference over non-members in the publication of manuscripts.

Article IV—*Officers and Executive Committee.*

Section 1. The activities of the Society shall be guided by an Executive Committee, consisting of the officers and three additional members, all elected by the members at a fixed annual meeting.

Section 2. The officers of the Society shall be a President, a First Vice-President, a Second Vice-President, a Recording Secretary, a Corresponding Secretary, a Treasurer, an Editor, and the member representing the Society as a Vice-President of the Washington Academy of Sciences.

Section 3. The officers shall serve for one year, assuming their duties at the termination of the annual meeting, and serving until their successors are elected and qualified, but there shall be no limitation as to the number of terms to which an officer may be reelected. The additional members of the Executive Committee shall be elected for a term of three years and each shall be ineligible for reelection until one year has elapsed following the expiration of his term. (At the first election under this Constitution one member would be elected for the full term, one for two years and one for one year.)

Section 4. The Society may elect, at any regular meeting, by a three-fourths majority of the members present an additional officer to be known as Honorary President, who shall serve in that capacity during his life. He shall be exempt from the payment of dues.

Article V—*Duties of Officers.*

Section 1. The Executive Committee shall assume the responsibility for and shall conduct the activities of the Society, act on nominations for memberships, direct its finances, provide for meetings and periodical, and shall report fully to the Society at least once each year, either through the different officers or by speciallly approved representative, on its conduct of the Society's business, such report to include an approved audit of the Treasurer's accounts. The Committee shall also consider and present to the Society proposals for change or improvement, and shall transact all other business requiring attention and not otherwise assigned.

Section 2. The President, or, in his absence, the senior officer

present (as listed in Article IV, Section 2) shall preside at all meetings of the Society and of the Executive Committee. The President or his substitute shall have authority to and shall appoint any standing or special committees whose services are required in the interests of the Society. The President shall deliver an address on some subject pertinent to the objectives of the Society at the first or second meeting subsequent to the completion of his term of office.

Section 3. The Recording Secretary shall make and preserve a record of the proceedings of the Society and of the meetings of the Executive Committee, and shall submit a record of the Society proceedings to the Editor for publication.

Section 4. The Corresponding Secretary shall conduct all of the official correspondence of the Society except that mentioned in Sections 5 and 6, shall keep a list of all the members and subscribers, together with their addresses, shall give due notice of all meetings, shall be responsible for the mailing of the periodical, and shall have custody of the reserve stock of the Society's periodicals and all other literature.

Section 5. The Treasurer shall have charge of and be responsible for all funds and investments of the Society, shall make disbursements or investments only at the direction of the Executive Committee, shall collect all sums due to the Society from any source, notify all members and subscribers who are in arrears, and shall present a report on the financial status of the Society annually to the Executive Committee and conduct such correspondence as is necessary to these duties.

Section 6. The Editor shall, under the direction of the Executive Committee, edit all publications of the Society and shall conduct any necessary correspondence relating to manuscripts.

Section 7. The Honorary President shall have no specific duties, other than to serve ex-officio as a member of the Executive Committee.

Article VI—*Publication Fund.*

The Society shall maintain a separate fund to be known as the Publication Fund which shall be derived from bequests and gifts, from the sale of complete sets of the periodical published by the Society, and from the fees of life and sustaining members. Only derived interest may be used for the Society's publication. At the discretion of the Executive Committee any unrestricted portion of the Publication Fund may be borrowed for publishing articles other than the regular periodical; such sums to be returned to the fund within five years.

Article VII—*Amendments.*

This Constitution may be amended at any regular meeting by a two-thirds vote of the members voting, if the total number

voting represents a quorum, provided that such amendment has been passed by a two-thirds vote of the Executive Committee and presented to the Society in written form at least one regular meeting prior to the meeting at which the vote is taken.

BY-LAWS.

Article I—*Election of Officers.*

At or before the regular November meeting the President shall appoint a nominating Committee which shall submit at the annual meeting a list of names comprising one or more nominees for each office, including membership in the Executive Committee, each selection to represent the Committee's best judgment in the interests of the Society. Other nominations for any office may be made from the floor. Elections shall be held separately for each office. When only one candidate for office is before the Society election shall be viva voce on motion and second from the floor. When two or more candidates are presented for an office, vote shall be by written ballots distributed, collected and counted by tellers appointed by the President.

Article II—*Filling of Vacancies.*

Vacancies in any office shall be filled by the Executive Committee. Members selected to fill such vacancies shall hold office only until the next annual election.

Article III—*Meetings.*

The regular meetings of the Society shall be held, unless otherwise ordered by the vote of the Society or of the Executive Committee, on the first Thursday of each month except July, August and September. The annual meeting for the election of officers shall be the regular meeting for the month of December. Special and field meetings may be called by the Executive Committee. Twenty members shall constitute a quorum.

The Executive Committee shall hold two fixed meetings during the year, one prior to January the fifteenth and one sufficiently prior to the Annual Meeting to permit the consideration and approval of the activities of the officers and the preparation of a report or reports for presentation at that meeting. Other meetings of the Executive Committee may be called at any time by the President or his substitute and shall be called promptly by the presiding officer on request of any three members of the Executive Committee other than the presiding officer. The presence of five members of the Executive Committee at any meeting shall establish a quorum.

Article IV—*Committees.*

Committees appointed by the President shall report to the Society at one of its meetings or to the Executive Committee as may be required.

Article V—*Order of Business at Meetings.*

The order of business at the regular meetings shall be as follows:

1. Reading and approving of the minutes.
2. Reports of officers and committees.
3. Election of members.
4. Miscellaneous business.
5. Presentation of notes and exhibition of specimens.
6. Reading of papers.
7. Introduction of visitors.
8. Adjournment.

The order of business at the Annual Meeting shall be:

1. Reading and approval of minutes of previous meeting.
2. Election of new members.
3. Reading and approval of Report of Executive Committee, including reports of the officers.
4. Presentation of report of Nominating Committee, vote, office by office, on candidates presented.
5. Miscellaneous business.
6. Presentation of notes and exhibition of specimens.
7. Introduction of visitors.
8. Adjournment.

Article VI—*Fees.*

The initiation fee shall be one dollar; the annual dues shall be three dollars payable January the first, or in the case of new members, one month after their election. Members elected at either of the last two meetings of the year are exempt from dues for the year in which they are elected. Members elected at any of the other meetings pay full dues for the year and receive all the numbers of the periodical for that year. On vote of Executive Committee a member one year in arrears for dues, after one month's notice to this effect, may be removed from the mailing list for the Society's periodical and shall be duly notified of such action by the Corresponding Secretary. A member who is two years in arrears for dues may be dropped from membership by vote of the Executive Committee after two months' notification. Reinstatement of such members with payment of all

arrears shall entitle each to withheld copies of the Society's periodical.

Article VII—*Amendments.*

These by-laws may be amended at any time by a two-thirds vote of the members voting at any regular meeting after presentation of the proposed amendments in writing at a previous regular meeting.

NOTES ON THE HISTORY OF THE CONSTITUTION OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

By H. E. Ewing and J. S. Wade.

On February 29, 1884, a small group of entomologists met at the home of C. V. Riley on Thirteenth Street, N. W., Washington, D. C., to consider plans for the formation of an entomological society. The chief item of business at this meeting was the appointment of a committee to draw up a constitution. The actual launching of The Entomological Society of Washington took place at the next meeting held on March 12, 1884, also at Dr. Riley's residence, when the constitution formulated by the committee was adopted. This constitution, published in 1886 (1), became the original unamended constitution of our society. It provided, among other things, for three classes of members,—active, corresponding and honorary. Also according to its provisions the office of Corresponding Secretary was separate from that of Treasurer.

The first amendment to the constitution was adopted in 1887 (2). It provided methods for the selection of the different kinds of members. The second amendment followed in 1892 (3). By its provisions the date of the annual meeting was changed from January to December, and the terms of office were fixed. At the meeting of February 4, 1904 (4), Article VII was amended so as to clarify and define the manner in which dues were to be paid by the different classes of members. The offices of Corresponding Secretary and Treasurer were united by an amendment adopted in 1909 (5), and in the same year the revised constitution was printed (5). Other amendments were adopted at the meeting of December 7, 1911 (6), and the third printing of the entire constitution followed in 1913 (6). The office of Editor was created by an amendment adopted in 1912 (7), that of Honorary President by one adopted in 1916 (8), and in 1918 an added amendment reduced the classes of members to two, viz: regular and honorary.

No further amendments were adopted until 1936, when the constitution was re-written and modernized, all articles except

the first being changed. This constitution, published in this issue of the Proceedings, is the fourth to be printed in its entirety. However, it represents the first adoption of a re-written constitution. This constitution was prepared by a committee and was ratified at the annual meeting on December 3. 1936.

REFERENCES DEALING WITH THE CONSTITUTION.

In the Proceedings of the Entomological Society of Washington: (1) Vol. I, pp. 5–7; (2)Vol. I, p. 78; (3) Vol. II, pp. 327–328; (4) Vol. VI, pp. 66–67; (5) Vol. XI, pp. 4–6; (6) Vol. XIV, pp. 19–21; (7) Vol. XV, pp. 20–21; (8) Vol. XVIII, pp. 83–84.

In the Journal of the Washington Academy of Science: (9) Vol. VIII, p. 179.

MINUTES OF THE 478TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

The 478th regular meeting of the Society was held at 8 P. M., Thursday, December 3, 1936, in Room 43 of the New Building of the National Museum. Forty-five members and eight visitors were present with S. B. Fracker presiding. The minutes of the 477th meeting were read and approved.

U. C. Loftin, chairman of the membership committee, presented the names of P. A. Woke of Beltsville, Maryland, and G. H. Bradley of Orlando, Florida, who upon recommendation by the Executive Committee were unanimously elected to the society.

The chair announced a reduced round trip fare offered to groups of 25 or more by the Pennsylvania Railroad for the Atlantic City meetings. W. B. Wood was appointed to take a listing of the people who wished to take advantage of this rate.

Upon invitation from the chair the following visitors introduced themselves to the society:

Dr. W. E. Ripper of Austria,
Mr. H. D. Smith of the Bureau's parasite laboratory at Paris, France,
Prof. R. C. Smith of Kansas State College,
Dr. W. H. W. Komp of the Panama Public Health Service.

J. C. Bridwell reported the capture at Kearny Station in Arlington County, Virginia, on July 4, 1936, of an alate female of Anergates atratulus (Schenck) in flight. This myrmicine ant is a social parasite of Tetramorium caespitum (Linn.) which has lost the worker caste and has not hitherto been recorded as present in this country.

Bridwell reported finding a sand coccoon of Bembecinus moneduloides (Smith) in May, 1936, near Vienna, Va., from which the adult had emerged. This was surrounded by the remains of the Homoptera stored for larval food. The remains represented some 15 individuals, all but one adults, which Mr. Oman determined as comprising eight species, 4 Cicadellidae, and 1 each in Membracidae, Cercopidae, Acanaloniidae, and Cixiidae. Bembecinus tridens (Fabri-

cius) of southern Europe has been studied by several persons and shows similar utilization of homopterous insects. Nests of a South African species, perhaps B. argentifrons (Smith), which Bridwell dug up at Capetown contained only adults of Bythoscopus olivaceus stal (Oman det.)

From the reports of the Frog-hopper Committee of Trinidad and Tobago, it does not appear that the possibilities of control through aculeate Hymenoptera preying upon Homoptera have been exhausted.

Bridwell reported that he had taken an Ampulicomorpha, either confusa Ashmead or a closely similar species, near Vienna, Virginia, in April and August, 1936, and has established that it attacks the nymphs of a mycophile fulgoroid of the family Achilidae, Epiptera floridae (Walker) (Oman det.) in the same manner that the Dryinidae attack their homopterous prey.

He reported that certain problematic borings in the corky scales of the outer bark of pitch pine (Pinus rigida) have been discovered to be made by undetermined species of Pemphredon, Passaloecus, and Stigmus. The flakes persist on the tree for many years and are utilized subsequently by numerous other aculeate Hymenoptera. Similar borings have been reported in the literature as having been made by Scolytidae. (Author's abstract.)

In the regular program, A. B. Gurney gave an interesting "Review of the Contributions of A. N. Caudell to Entomology." The speaker first emphasized the respected position held by Mr. Caudell as a result of his published papers. In the study of American Orthoptera his work with the Decticinae, Rhaphidophorinae, Mantidae, and Phasmidae was of a pioneer nature. In the worldwide field, seven fascicles of Genera Insectorum were a notable contribution. Fundamental taxonomic work in families outside the Orthoptera proper was included under his 230-odd titles.

Among Mr. Caudell's unpublished contributions special mention was made of the preparation of catalogues in Lepidoptera, Orthoptera and other groups, the studied but unreported collections prepared by him in certain minor groups and a local manual of Dermaptera and Orthoptera in cooperation with H. A. Allard. Items of particular personal interest regarding his early years in the Middle-West are to be found in Mr. Caudell's Entomological Diary which was begun as a boy when his only entomological contacts were in the form of correspondence with Miss Mary E. Murtfeldt and Drs. L. O. Howard and C. V. Riley. (Author's Abstract.)

This paper was discussed by McIndoo, Ewing, Busck and Bridwell.

The subject of the revised constitution was taken up and the chairman announced that it was his understanding from our present constitution that a two-thirds vote of the members present was necessary in order to pass the proposed amendments. The Executive Committee at their meeting on December 1, 1936, had discussed the proposed amendments made at the last meeting and approved all of them with the exception of (1) that offered by Hall on Article V, Section 1, in which the Executive Committee was made responsible "individually" as well as jointly for the activities of the Society, and (2) that offered by Webb in Article V, section 5, in which the treasurer was to be bonded in the amount of $5000. The Executive Committee had looked into the matter of a bond and found that usually these protect the society only against loss by dishonesty or fraud and the Executive Committee did not favor them.

On request by Bridwell, Ewing discussed the various changes in the new Constitution. Weigel objected to the idea of asking the nominating committee to bring in the names of two nominees for each office. Cushman made the motion to reconsider Article I of the By-Laws, stating that he thought small changes in the amendments could be made at this time if wished without carrying the matter over for vote at a later meeting. After some discussion by A. B. Gahan, this was seconded and passed. Gahan then made the motion that the Nominating Committee bring in only one nominee for each office. This was discussed by Heinrich, Wood, and Muesebeck. Bishopp stated that the present Nominating Committee had found it difficult and embarrassing to present two nominees for each office. He thought the Society should not bind itself too closely and was in favor of giving the Nominating Committee the power to bring in one or more nominees. After further discussion by Gahan, Heinrich, and Bridwell, the Gahan amendment was voted down. Cushman had moved that Article I of the By-Laws read that the Nominating Committee submit a list of names comprising "one or more nominees for each office." This was seconded and passed. Ewing then made the motion that the revised Constitution and By-Laws with all the approved changes be accepted by the Society. This was seconded and passed unanimously.

By previous vote of the Executive Committee the revised Constitution and By-Laws will be published in the Proceedings of the Society and will be accompanied by a brief statement embodying essential information concerning the previous status of the Constitution and citation of references to publications of previous revisions.

The Nominating Committee of E. A. Chapin, C. A. Weigel, W. B. Wood, A. G. Böving, B. A. Porter, J. S. Wade, and F. C. Bishopp, Chairman, brought in nominations for the annual election of officers—the following being elected for the year 1937:

Honorary President	L. O. Howard
President	N. E. McIndoo
First Vice-President	E. A. Back
Second Vice-President	R. E. Snodgrass
Recording Secretary	Catherine Ford
Corresponding Secretary	D. J. Caffrey
Treasurer	H. E. Ewing
Editor	W. R. Walton
Executive Committee	J. S. Wade, B. A. Porter, S. B. Fracker
Nominated to represent the Society as Vice-President of the Washington Academy of Sciences	C. F. W. Muesebeck

Meeting adjourned at 10.05 P. M.

Henry H. Richardson,
Recording Secretary.

Actual date of publication, February 4, 1937.

VOL. 39 FEBRUARY, 1937 No. 2

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OF THE

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OF WASHINGTON

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THE

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Annual dues for members are $3.00; initiation fee $1.00. Members are entitled to the Proceedings and any manuscript submitted by them is given precedence over any submitted by non-members.

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First Vice-President . . . . E. A. BACK
Second Vice-President . . . . R. E. SNODGRASS
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PROCEEDINGS OF THE

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THE GENUS DIKRANEURA—A STUDY OF THE MALE GENITALIA—WITH DESCRIPTIONS OF NEW SPECIES.

By Dwight M. DeLong and J. S. Caldwell,
Department of Zoology and Entomology, Ohio State University.

The Genus *Dikraneura* as known previously has now been separated into a number of distinct groups, genera and subgenera, by several authors. The whole group of species known at that time was treated by Gillette as *Dikraneura* in 1898.[1] In 1925[2] Ball and DeLong erected the Genus *Alconeura* and treated the species of this group and *Dikraneura*. In 1926[3] McAtee described the Genus *Hyloidea* and the type species. In 1929[4] Lawson erected the Genus *Dikraneuroidea* describing the type of the species and in 1930[5] he described several new species of Dikraneura. In 1934[6] and 1936,[7] Beamer described some new species of *Dikraneura* and *Alconeura*. In 1936[8] DeLong and Caldwell described the Genus *Forcipata* and several new species belonging to that group. The internal male genitalia were illustrated in this latter paper, but have not been used for other genera and subgenera. The present treatment is an attempt to study the group by the aid of the male genitalia and has helped us gain a much better idea of the relationships of the species and characters which distinguish them.

Key to Dikraneura and closely allied genera and subgenera.

1 Second pair of wings with two closed apical cells 2
1′ Second pair of wings with one closed apical cell 7
2 (1) Second apical cell of elytra pedunculate basally 3

[1] Gillette, C. P. Proc U. S. Nat. Mus. 20 : 715–724, 1898.
[2] Ball, E. D. and DeLong, D. M. Anns. Ent. Soc. Amer. 18 : 324–337, 1925.
[3] McAtee, W. L. Jour. N. Y. Ent. Soc. 34 : 162, 1926.
[4] Lawson, P. B. Bull. Brooklyn Ent. Soc. 24 : 307–308, 1929.
[5] Lawson, P. B. Can. Ent. 62 : 35–42, 1930.
[6] Beamer, R. H. Can. Ent. 66 : 15, 1934.
[7] Beamer, R. H. Can. Pac. Ent. 12 : 7–8, 1936.
[8] DeLong, D. M. and Caldwell, J. S. Anns. Ent. Soc. Amer. 29 : 70–77, 1936.

2′		Second apical cell of elytra not pedunculate, with cross vein at base	4
3	(2)	Head flattened and wider than pronotum	*Hyloidea*
3′		Head not flattened, cylindrical, not wider than pronotum	*Alconeura*
4	(2′)	Male plates cylindrical proximal at base and apex but widely separated at middle. Elytra with cross vein of first apical cell wanting, second cross vein more caudal than third	*Forcipata*
4′		Male plates flat, triangular, usually contiguous for at least half their length, not widely separated at middle. Elytra with cross vein of first apical cell present	5
5	(4′)	Second and third cross veins decidedly caudal to first and fourth cross veins	6
5′		First cross vein and sometimes fourth as nearly caudal or more so than second and third cross veins	*Dikraneura*
6	(5)	Male plates long, acutely pointed at apex, female segment entire	*Notus*
6′		Male plates very short and broad, female segment not entire, represented only by lateral lobate portions, vertex rounded or bluntly angled	*Curta*
7	(1′)	Cross veins of elytra forming almost a straight line, second apical cell pedunculate, body form flattened	*Dikraneuroidea*
7′		Cross veins of elytra not forming a straight line, body form not flattened	8
8	(7′)	Elytra with third apical cell parallel sided or quadrate	*Idona*
8′		Elytra with third apical cell bounded by curved veins which form an irregular shaped cell but not quadrate	*Typhlocybella*

Key to species of subgenus Dikraneura.

1		Conspicuously marked with red coloration or with red bands or stripes	2
1′		Usually white, yellow or brown, not marked with red	8
2	(1)	Vertex pronotum and elytra with red spots or dots	*maculata*
2′		Red coloration usually in form of spots or bands	3
3	(2′)	With a red transverse band across elytra just before middle	*cockerelli*
3′		Without reddish transverse band	4
4	(3′)	Vertex, pronotum and claval area almost uniform dark red	*rubens*
4′		Elytra usually with short oblique reddish bands	5
5	(4′)	Deep yellow with oblique stripes dark red	var. *nevadensis*
5′		Pale yellow, or white tinged with yellow, red oblique stripes lighter in color	6
6	(5′)	Male oedagus with a dorsally directed median portion, bearing a caudally directed terminal process, apical portion short, directed caudally	*californica*
6′		Apical portion of oedagus long, slender, curved dorsally and caudally	7
7	(6′)	Dorsally directed portion of oedagus with paired processes on caudal portion	*pusilla*

7′ Dorsally directed portion of oedagus without processes on caudal portion .... *cruentata*

8 (1′) White with a black spot on inner angle of first apical cell of elytra (described from unique female, male unknown) .... *mera*

8′ Usually yellowish or green in color, sometimes tinged with tan, without black spots in outer cell of elytron 9

9 (8′) Male plates with an enlargement about middle on outer margin, each bearing a pair of conspicuous tooth-like structures .... *readionis*

9′ Male plates normal in form without enlargement or tooth-like structures 10

10 (9′) Color bright or pale yellow 11

10′ Color dark greenish brown, orange or tan 13

11 (10′) Veins of elytra darkened just before cross veins, genitalia as in *californica* .... *californica* var. *imbellus*

11′ Veins of elytra not darkened before cross veins, oedagus with long slender dorsally directed processes 12

12 (11′) Basal dorsally directed portion of oedagus consisting of one broad dorsal process, a pair of broad dorsal processes and a a pair of ventral processes .... *aurulenta*

12′ Basal dorsally directed process consisting of a narrow single portion, without paired processes .... *sandersi*

13 (9′) Dull brownish green, two white transverse bands on margin of vertex bordered by narrow black lines. Spine of ninth segment in male heavy, arising at caudal margin of segment and curving dorsally and outwardly .... *marginella*

13 (12′) Vertex, pronotum and scutellum tan or orange, pale margin on vertex not well defined, spine of ninth segment, broad, short, not extending beyond caudal margin of segment .... *kunzei*

The male of *mera* is unknown and consequently could not be illustrated. Also in the January, 1936 number of the Pan Pacific Entomologist Dr. Beamer described two species of this group, *aegra* (*mera* Beamer) which resembles *maculata*, and *santana* (closely related to *rubens*) which have not been examined nor included in this study.

Dikraneura maculata Gill.

D. maculata Gill. Proc. U. S. Nat. Mus., XX, p. 716, 1898.

D. celtidis Obs. Ohio Biol. Surv. Bull. 14, p. 344, May, 1928.

Male oedagus with a short, dorsally directed basal process and a long narrow sharply angled apical process which also extends dorsally. Styles with a narrow basal third and the apical two thirds broader, apex curved from outer margin to produced inner margin. Spines of ninth segment long, curving ventrally and caudally.

Eastern United States on hackberry.

Dikraneura cockerelli Gill.

D. cockerelli Gill. Psyche 7 : Supp. p. 14, 1896.

Male oedagus with a very short narrow basal process arising from base of apical portion which is long and broad with apex forming three processes. A central anteriorly curved portion is the terminus of the oedagus and on each side arises a more slender dorsally and laterally directed process. Styles narrow on basal half, apical half broad, a pointed spine-like process arising on inner portion and directed inwardly beyond apex. Spines of ninth segment long, arising on dorsal portion tapering to sharp pointed apex directed caudally and curved outwardly.

Known only from the Southwestern United States.

Dikraneura rubens Beamer.

D. rubens Beamer, R. H. Can. Ent. 66 : 16, 1934.

Male oedagus with the basal process narrowed at base, then enlarged directed dorsally and slightly curving anteriorly. Apical portion long, filamentous directed dorsally and inwardly, the two pieces crossing before their middle. Styles with narrow basal half, apical half broader with a long inwardly directed pointed process arising just before apex. Spine of ninth segment wanting.

Known from specimens from Arizona only.

Dikraneura pusilla Lawson.

D. pusilla Lawson. Can. Ent. 62 : 37, 1930.

Male plates long, tapered to narrow but blunt apices. Oedagus with a short dorsally produced process at base. A median process also extends dorsally about twice the distance of basal process and bears two pairs of processes on the caudal side. One pair is long and extends dorsally, the other is short and extends caudally. The apical portion consists of a single process which is long and extends dorsally and caudally. Styles narrow on basal half and broadened on apical half with a curved finger-like process extending inwardly and caudally on inner margin. Spine of ninth segment long, narrow, extending caudally and ventrally.

Known to occur only in Texas.

Dikraneura cruentata Gill.

D. cruentata Gill. Proc. U. S. Nat. Mus. 20 : 717, 1898.

D. kansiensis Lawson. Can. Ent. 62 : 38, 1930.

Male plates narrowed to blunt apices. Oedagus with a basal process which extends dorsally is enlarged on apical half and bears a posterior rounded and dorsally directed lobe. Ventral portion broadly curving to form a long very slender apical portion which extends dorsally and caudally. Styles long, basal half narrow, apical half broad, posterior margin concavely rounded, forming a pointed process on outer margin and a longer produced finger-like process on inner margin; spine of ninth segment long, narrow, arising dorsally and directed caudally and ventrally, a dorsal tooth at about the middle.

Common in eastern United States and reported from Colorado and California.

Dikraneura readionis Lawson.

D. readionis Lawson. Can. Ent. 62 : 39, 1930.

Plates long, narrowed to blunt apices which are divergent, an enlargement about middle on outer margin of each bears a pair of conspicuous tooth-like structures. Oedagus with a short rounded, dorsally produced basal process bearing on its posterior margin a pair of slender dorsally directed processes. Apical portion consisting of a pair of extremely long slender, curving, dorsally directed processes as long as anal tube. Styles long, narrow on basal half, apical half broad, with a long blunt finger process on inner margin. Spine of ninth segment short, slender, with apex curved upwardly.

Known only from Arizona.

Dikraneura californica var. **imbellis** Lawson.

D. californica var. *imbellis* Lawson. Can. Ent. 62 : 37, 1930.

Male plates long, rather gradually and concavely narrowed on apical half to blunt apices. Oedagus with a basal dorsally directed process, a central portion extending dorsally with a long caudally directed apex and an apical portion which extends caudally and is tapered to a pointed apex. Styles narrow on basal half and broad on apical half with a rather long inwardly directed process on inner margin. Spines of ninth segment long, arising on dorsal portion of segment, extending caudally with apical half bent ventrally and caudally.

Collected only in California.

Dikraneura aurulenta Lawson.

D. aurulenta Lawson. Can. Ent. 62 : 41, 1930.

Male plates long and broad, only slightly narrowed before apex. Male oedagus complicated in form consisting of a single and three pairs of processes. The basal process extends dorsally and is composed of a broad pointed process extending anteriorly and a similar one on the posterior side extending dorsally. Just below this a pair of similar portions extend dorsally on either side of the posterior process and still below the base of these a pair of small processes extend ventrally and curve posteriorly. The apical portion of the oedagus is composed of a pair of long curved slender processes arising at the base and extending dorsally beyond the processes of the basal portion. Styles long, narrow, the apical portion more strongly narrow to apex, which is enlarged and produced inwardly where the pointed apices almost touch. Spine of ninth segment broad, pointed at apex and extending caudally almost to caudal margin of segment.

Known to occur only in Texas.

Dikraneura sandersi Ball & DeL.

D. sandersi Ball & DeL. Anns. Ent. Soc. Amer. 18 : 332, 1925.

Male plates long, tapered to blunt apices. Oedagus with a looped portion which curves back upon itself. The dorsal portion of the loop with a long, broad apical process which extends caudally and dorsally. This bears a basal dorsally directed process just before the curved portion which forms a ventral portion of the loop which extends dorsally and caudally paralleling the dorsal

portion and extending to about the same length but which is much narrower in width. Styles long and narrow in ventral view, enlarged at apex on inner margin on which are formed slightly produced processes. Spines of ninth segment arising on dorsal portion directed caudally and slightly ventrally and not extending beyond apex of segment.

Known only from Central America.

Dikraneura marginella Baker.

D. marginata DeL. N. Y. Ent. Soc. 32 : 68, 1924.

D. marginella Bak. Philippine Journal Sci. 27 : 160, 1925.

(n. n. for *marginata*, preoccupied by *D. marginata* Sahl. 1871.)

Male oedagus with basal portion extending anteriorly and caudally. Apica portion curving dorsally with apex directed anteriorly. Styles angled at base, broad on basal half, apical half narrower, curved outwardly and with apex directed inwardly. Spine of ninth segment heavy, arising at apex of segment, curved upward and outwardly.

Known only from Florida and Central America.

Dikraneura kunzei Gill.

D. kunzei Gill. Proc. U. S. Nat. Mus., XX, p. 721, 1898.

Male plates long, tapered to blunt apices. Oedagus with a rather broad basal portion which extends dorsally. A median process is longer and more narrow, directed dorsally and tapering to a sharp pointed apex. The apical portion is a continuation of the ventral portion and is short, extending caudally and slightly dorsally. Styles long and rather narrow, slightly enlarged at apices and with a produced process on outer portion. Spine of ninth segment rising on dorsal portion, short and broad.

Known only from the Southwestern United States.

Key to Species of Subgenus Notus.

1 Length more than 4 mm. Elytra unusually long and narrow.....*elongata*

1′ Length not exceeding 4.0 mm. Elytra not unusually long.....2

2 (1′) Ninth segment with conspicuous spines either on body of segment or at apex.....3

2′ Ninth segment without a conspicuous spine.....*luna*

3 (2) Male oedagus curved so as to form a U-shaped or V-shaped structure by a basal dorsally directed portion and a posteriorly dorsally directed portion.....4

3′ Male oedagus not U-shaped or V-shaped in form, if appearing so, with a basal portion extending anteriorly.....12

4 (3) Spine of ninth segment with caudal edge sloping dorsally and anteriorly and notched or serrate.....*serrata*

4′ Caudal edge of spine on ninth segment not serrate.....5

5 (4′) Terminus of oedagus with transverse process which bears anterior and posterior directed processes at each end.....*abnormis*

5′ Terminus of oedagus enlarged, tapered or bent but without processes on lateral terminus.....6

6 (5′) Oedagus with terminus curved forward, spine of ninth segment arising on dorsal margin curved inwardly and anteriorly at apex of ninth segment 7

6′ Terminus of oedagus not curved forward, spine of ninth segment arising or appearing to arise on apical margin of ninth segment 8

7 (6) Ninth segment rather broadly rounded on apical margin. Color white or pale green .... *torta*

7′ Ninth segment strongly narrowed to narrowly rounded apex. Color pale yellow .... *augustata*

8 Apex of oedagus bent abruptly caudally 9

8′ Apex of oedagus tapering and curved but not bent abruptly caudally 11

9 (8) Reddish in color, male oedagus narrowed toward apex 10

9′ Yellowish green in color. Male oedagus not narrowed before apex .... *arizona*

10 (9) Male oedagus with small process on caudal margin near apex extending dorsally, apex of ninth segment tapered to form a pointed spine .... *rufula*

10′ Male oedagus without a process on caudal margin extending dorsally near apex, apex of ninth segment forming a slender spine which is long, extending dorsally and anteriorly .... *rubrala*

11 (8′) Male oedagus with a pair of lateral processes arising not far from apex .... *carneola*

11 Male oedagus without lateral processes .... *absenta*

12 (3′) Tinged with red, veins of elytra reddish, oedagus with caudally bent terminal, lateral and anterior processes .... *rubica*

12′ White, green or yellowish in color, oedagus with either caudal or lateral process or with neither 13

13 (12′) Posterior portion of male oedagus divided into three long slender processes extending dorsally .... *dubita*

13′ Posterior portion of male oedagus consisting of only one main process 14

14 (13′) Posterior process of oedagus tapered to pointed or narrow apex without terminal processes 15

14′ Posterior process of oedagus with terminal processes 16

15 (14) Posterior process slender with sharp pointed apex .... *termina*

15′ Posterior process broader with a pair of lateral processes near apex .... *arcta*

16 (14′) Apex of oedagus with a pair of anterior and a pair of posterior processes, spine of ninth segment arising ventrally and curved dorsally .... *urbana*

16′ Apex of oedagus with a pair of lateral processes, spine of ninth segment long, slender, directed ventrally and caudally .... *mali*

D. robusta Lawson is known only by a single male specimen which was examined but not dissected. The holotype male of *D. hungerfordi* Lawson was also examined but not dissected,

and consequently no illustrations of these two species are included. Both types are in the Snow entomological collection, University of Kansas.

Dikraneura (Notus) luna, n. sp.

A blunt headed species resembling *Empoasca* in form and coloration but with distinct genitalia. Length 2.7 mm.

Vertex more than one third wider between eyes than length at middle.

Vertex, pronotum and scutellum yellowish green. Elytra dark smoky, veins broadly green.

Genitalia: Female last ventral segment rather short, truncate, a black marginal spot on middle of segment. Male plates rather long, apical half gradually tapered to blunt, rounded tips. Styles constricted at middle, both terminal portions broader and rounded. Apical portion with a short finger-like process arising on inner apical margin and curving outwardly. Oedagus long, curving dorsally and slightly anteriorly with apex tapered and sharply pointed. A pointed basal portion curves anteriorly and slightly dorsally and together they give the appearance of a sickle. Spines of pygofers wanting.

Described from one male from Mojave, California, July 7, 1933, three females from Tehechapi, Calif., July 7, 1933, and a male and female from Palmdale, Calif., July 6, 1933, all collected by Dr. R. H. Beamer. Male holotype from Mojave, female allotype from Tehechapi and male and female paratypes in Snow collection, University of Kansas. Male and female paratypes in collection of senior author.

Dikraneura (Notus) serrata, n. sp.

In general appearance resembling *abnormis*, but more strikingly marked and with distinct genitalia. Length 4 mm.

Vertex bluntly angled, a little wider between eyes than length at middle. Elytra long, greatly exceeding abdomen, color yellowish with two broad red stripes extending from apex of vertex to basal angles of scutellum. Elytra marked with oblique reddish brown stripes. Two are on claval area, one anterior to claval suture and anterior half of elytra reddish brown, veins between these stripes white.

Female last ventral segment with posterior angles produced and prominent, between which the posterior margin is slightly concavely rounded and embrowned at middle as in *mali*. Male plates triangular, gradually tapering to long narrow apices. Male oedagus with the basal arm extending dorsally to the base of the anal tube, the apical portion appearing broad in lateral view, apical portion long, extending dorsally and caudally, concave with two outer pointed teeth. A pair of rather long processes arising on ventral caudal margin, about half way to apex and curving laterally. The spine of the pygofer is long, reaching to its posterior margin where it is obliquely angled dorsally and anteriorly, posterior margin serrate. Styles long, constricted near apex and enlarged with an inner apical finger.

Described from a series of 42 specimens collected at Santa Rita Mts., Arizona, June 12, 1933, by Dr. R. H. Beamer. Male holotype, female allotype and male and female paratypes in Snow collection, University of Kansas. Male and female paratypes in collection of the senior author.

Dikraneura abnormis (Walsh).

Chloroneura abnormis Walsh. Prairie Farmer, Sept. 6, 1862, reprinted Boston Soc. Nat. Hist., IX, p. 316, 1864.

Male oedagus U-shaped, basal portion in lateral view broad and directed dorsally almost to base of anal tube, apical portion with basal half broad, then tapering to very narrow apical portion which bears a branched bifurcate portion at tip. This consists of an apical cross bar at the end of which on each side is a bifurcate spine, the longer arm of which extends caudally and the anterior arm, anteriorly. Just below this terminal process a pair of lateral processes arise from the slender portion of the oedagus. Styles long and slender, curved inwardly near apex and with an enlarged area on outer margin. Spines of ninth segment large, curving dorsally and bent outwardly at apex.

Occurring east of the Rocky Mountains.

Dikraneura (Notus) torta, n. sp.

In general form and appearance resembling *urbana*, but with distinct genitalia. Length 4 mm.

Vertex bluntly angled, one-third wider between eyes than length at middle. Pronotum almost twice as long as vertex. Body long and narrow.

Color: vertex straw yellow, pronotum pale yellow, disc tinged with orange. Elytra subhyaline, veins yellowish.

Genitalia: Male plates gradually tapered to bluntly angled apices. Oedagus U-shaped with the basal portion bluntly rounded and only about half as long as apical half, which is rather broad and appears twisted and pointed at apex. A pair of lateral processes arise near apex, which are quite conspicuous and which extend ventrally and anteriorly. The spines of the ninth segment appear recurved in lateral view extending inwardly and anteriorly with the recurved portion tapering to pointed apices. Styles in ventral view long, rather broad at base, constricted at middle and rather broad at apex, where they are abruptly narrowed, each having a finger process on inner margin.

Described from three male specimens collected at Chiricahua Mts., Ariz., June 9, 1933, by Dr. R. H. Beamer. Male holotype and male paratype in Snow collection, University of Kansas, male paratype in collection of the senior author.

Dikraneura augustata Ball & DeLong.

D. augustata Ball & DeL. Anns. Ent. Soc. Amer. 18 : 328, 1925.

Male oedagus with anterior process rather short, extending dorsally and bluntly rounded. Apical portion broad at base, narrowed toward apex, where it appears to be folded over. A pair of lateral processes arise near apex. Styles

long, basal half narrow, gradually broadened to apex, which bears a slightly rounded process on outer margin and a more produced, angled process on inner margin. Spine of ninth segment arising dorsally, apex long, slender, sharply pointed, extending inwardly and curving anteriorly.

Known from the eastern United States, Kansas and Texas.

Dikraneura (Notus) arizona, n. sp.

Resembling *mali* in form and general appearance but darker in color and with distinct genitalia. Length 3.7 mm.

Vertex bluntly angled, almost twice as wide between eyes as length at middle. Pronotum almost twice as long as vertex.

Color yellowish green tinged with brown, elytra greenish smoky subhyaline.

Genitalia: Female last ventral segment broadly roundedly produced. Male plates rather long and broad, apices bluntly angled and divergent. Male oedagus V-shaped, the basal portion directed dorsally and enlarged at apex. The apical portion is broad, directed dorsally with tip bifurcate and bent caudally. A pair of lateral processes arise not far from oedagus and extend laterally and dorsally. Styles in ventral view rather narrow, apex with an outer rounded lobe and an inner finger process. Spines of ninth segment arising at upper apical edge directed upward, slightly forward, and laterally.

Described from a series of 16 specimens collected at El Paso Co., Colo., June 19, 1929, Santa Rita Mts., July 17 and June 12, Douglas Co., Colo., June 27, 1929, Chiricahua Mts., Ariz., June 9 and July 8, Hauchuca Mts., Arizona, July 8, and Granite Dell, Arizona, July 30, 1933.

Male holotype and female allotype from El Paso, Colo., and male and female paratypes in Snow collection, University of Kansas. Male and female paratypes in collection of senior author.

Dikraneura rufula Gill.

D. abnormis var. *rufula* Gill. Proc. U. S. Nat. Mus., XX, p. 720, 1898.

The male oedagus has a basal portion extending dorsally half way to base of anal tube. The apical portion is long, directed dorsally, where it forms two processes. An anterior one extends upwards and is bent caudally, a short posterior process extends dorsally beneath the anterior one. In ventral view it appears to be broadened at apex. A pair of lateral spines arise from the enlarged portion near the base. Styles rather short, enlarged and curving outwardly near middle, an enlarged portion on outer margin near apex. Spine of ninth segment produced at apex of segment, broad at base, tapering to pointed apex, which is slightly curved outwardly at tip.

Known only from California.

Dikraneura (Notus) rubrala, n. sp.

Resembling *carneola* in general appearance but with distinct coloration and genitalia. Length 3.2 mm.

Vertex bluntly angled, more than one-third wider between eyes than length at middle.

Color: Yellowish marked with rose red. A spot on either side at base of vertex and an irregular area covering the disc of pronotum red. Elytra reddish, claval area and commissural line white, apical portion subhyaline, veins reddish.

Genitalia: Female last ventral segment broadly rounded and slightly produced at middle. Male plates long, concavely narrowed on apical half to rather blunt apices. Oedagus U-shaped, basal portion directed dorsally, apical portion long, broad at base, tapered to apex, which is directed caudally and is broad with a broad apical notch forming two diverging apical spines. A pair of lateral processes arise not far from apex. Styles narrow on basal half, broadened on apical half with a projecting, pointed finger-like process on inner margin. Spines of ninth segment formed at apex of segment, rather long and narrow, directed upwards, slightly forward and with apices turning outwardly.

Described from four male and four female specimens from Taylor's Falls, Minn., August 16, 1916, and one male specimen from Bayfield, Wis., August 10, 1916, all collected by J. G. Sanders and the senior author. Holotype male and allotype female from Taylor's Falls, Minn., and male and female paratypes from Taylor's Falls, Minn., and Bayfield, Wis., in the collection of the senior author.

Dikraneura carneola (Stal.).

Typhlocyba carneola Stal. Stet. Ent. Zeit., XIX, p. 196, 1858.

Male plates rather long, concavely tapering to blunt, narrow apices. Spines of ninth segment large, in lateral view appearing "S" shaped. Rather heavy at base, apical portion pointed upward and tapered to pointed apex. Oedagus in lateral view U-shaped with basal portion shorter and blunt on upturned apex. Apical portion longer, enlarged a short distance from apex with a pair of lateral processes arising on the caudal margin and curving laterally, ventrally and anteriorly. Apex in lateral view tapering and recurved. In ventral view appearing bifurcate. Styles rather short, slightly curved outwardly, a little wider on basal than on apical half.

Known to occur only in the western and northwestern States.

Dikraneura carneola var. **shoshone**, n. var.

In form and appearance resembling *carneola* but with apical portion of oedagus differing.

Color yellowish, tinged with dull red, claval vein white.

The oedagus resembles that of carneola but the apex is recurved and in ventral view appears enlarged with the lateral portions curved caudally. It agrees with *carneola* in being enlarged and bearing the lateral processes.

Described from three male specimens collected by the senior author at Shoshone Basin, Idaho, July 27, 1930. Holotype male and male paratypes in senior author's collection.

Dikraneura (Notus) absenta, n. sp.

Resembling *carneola* in general form and appearance but with different male genitalia. Length 3.5 mm.

Vertex strongly produced and bluntly angled, more than one-third wider between eyes than length at middle. Elytra long and narrow as in *carneola.*

Color dull green without definite color markings.

Genitalia: Female last ventral segment with lateral angles of posterior margin rounded. Central half shallowly emarginate. Male plates long, gradually tapering to narrow, but rounded apices. Male oedagus similar to *carneola* but with apical portion of U-shaped loop gradually tapered to bifurcate apex, without enlarged portion or the lateral processes which are typical of *carneola.*

Described from a series of 95 specimens collected in Idaho, California, Arizona, British Columbia, Washington, Oregon, Colorado and Utah, by Dr. R. H. Beamer, B. T. Peters and the senior author. Holotype male from Craters of the Moon, Idaho, collected June 9, 1930, and allotype female from Kalona, Washington, July 21, 1931, and male and female paratypes in collection of senior author. Male and female paratypes in Snow Collection, University of Kansas.

Dikraneura (Notus) rubica, n. sp.

In general appearance and coloration resembling *rufula* but with distinct genitalia. Length 3.5.

Vertex about one third wider between eyes than length at middle.

Color: Vertex yellow, tinged with orange, pronotum pale with disc dull reddish. Scutellum yellowish. Elytra dull reddish. Claval suture pale.

Genitalia: Female last ventral segment rounded and sloping from about half its length to posterior margin, which is about half the width of segment and is truncate. Male plates gradually tapered to bluntly rounded apices. Styles wedge shaped with apical portion broad and bearing a short heavy finger-like process on inner margin. Oedagus with a narrow basal process extending dorsally about half way to the base of anal tube. Apical portion broader with a short spine extending anteriorly, a pair of processes arising dorsal to these on the caudal margin and extending laterally and a narrower terminal portion which curves caudally. Spine of pygofer extending from apex of the ninth segment, curved outwardly at apex.

Described from one male and one female specimen collected at Grand Canyon, Arizona, in August, 1930. Male holotype and female allotype in collection of the senior author.

Dikraneura (Notus) dubita, n. sp.

Resembling *abnormis* in general appearance but with vertex more bluntly angled and with distinct genitalia. Length 3 mm.

Vertex as long as width between eyes, not quite as long as pronotum.

Color yellowish with three pale elongated areas on vertex. A long one on

middle and a shorter one either side. Pronotum mostly milky white except yellowish area on disc. Scutellum white except basal angles, which are yellowish.

Genitalia: Male plates tapering on apical half to form blunt and rather broad apices. Styles broad, rounded on basal end, apex sloping from outer margin to form produced inner margin. Oedagus in lateral view with broad basal portion which is truncate anteriorly. Constricted, then forming a broad dorsally directed apical portion which is divided into three long finger-like processes which extend to dorsal wall of pygofer. Spine of ninth segment very short, broad and pointed.

Described from a single male specimen from Estes Park, Colorado, collected August 25, 1930, by Prof. H. C. Severin, which is unique in type. Male holotype in collection of senior author.

Dikraneura (Notus) termina, n. sp.

Resembling *carneola* in general form and appearance but more slender, elongate and with distinct genitalia. Length 3.7 mm.

Vertex bluntly angled, about one-third wider between eyes than length at middle.

Color: yellow tinged with dull greenish without definite color markings. Elytra smoky subhyaline, veins yellow.

Genitalia: Female last ventral segment produced, lateral angles rounded, posterior margin truncate. Male plates gradually tapering to blunt narrow apices. Styles rather short, wedge shaped, apices rather broad, with an inner caudally directed finger-like process. Oedagus in lateral view with a basal process extending dorsally about half way to the anal tube. Apical portion extending dorsally and caudally, apex narrowed to a sharp point. Pygofer spines arising on outer, apical margin and directed dorsally and caudally with apices turned sharply outwardly.

Described from a series of three male and four female specimens collected at Oak Creek Canyon, Arizona. One female was taken July 31, 1933, and the others August 9, 1932. All collected by Dr. R. H. Beamer. Male holotype, female allotype and male and female paratypes in Snow collection, University of Kansas. Male and female paratypes in senior author's collection.

Dikraneura (Notus) areta, n. sp.

Resembling *augustata* in general form and appearance but with distinct genitalia. Length 3 mm.

Vertex strongly produced and bluntly angled, about one-fourth wider between eyes than length at middle. Elytra long and narrow.

Color: Cream washed with yellowish. Elytra subhyaline, basal third and veins yellow.

Genitalia: Male plates long, apical half tapering, concavely rounding on outer margin, to blunt but rather pointed apices. Spine of pygofer arising on dorsal apical margin, apical portion curved upwardly, inwardly and anteriorly. Styles

in ventral view long, basal half slender, apical half broader and curved inwardly, apex pointed. Oedagus with basal process which is rather broad, extending dorsally and curved at apex. Apical portion long, rather broad, enlarged just before tapered, bluntly pointed tip. A pair of short lateral processes arising from enlarged portion near apex.

Described from a single male specimen collected at Red Lake, Arizona, August 5, 1933, by Dr. R. H. Beamer. Holotype male in Snow collection, University of Kansas.

Dikraneura urbana, Ball & DeLong.

D. abnormis var. *urbana* Ball & DeL. Anns. Ent. Soc. Amer., 18 : 329, 1925.

Male oedagus in lateral view appearing very much like *abnormis* but the basal portion is much shorter and the apical portion is much broader near apex. A pair of long bifurcate processes at apex extend caudally and a smaller pair extend anteriorly. Styles long, basal half narrow, apical half constricted about middle and enlarged either side. The apex is the broadest portion with the caudal margin concavely rounded. Spines of ninth segment arising ventrally, constricted at about half their length and produced to form sharp pointed apices which are directed outwardly and dorsally.

Described from and known only by specimens from Iowa.

Dikraneura mali (Prov.).

Erythroneura mali Prov. Pet. Faune Ent. Can., III, p. 298, 1890.

Male oedagus long, with a short broad basal process directed anteriorly and dorsally with the apex curved caudally. Apical portion long, with apex curved anteriorly. A pair of long lateral processes arising at apex and directed laterally. Spines of ninth segment long extending, posteriorly and ventrally across ninth segment, with apex bent anteriorly. Styles in ventral view with basal half narrow, apical half broadened to the apex, which appears deeply notched between outer and inner produced margin, the latter of which is formed into a finger-like process.

Occurring east of the Rocky Mountains.

Subgenus CURTA nov.

Venation as in *Notus* but with rounded or bluntly angled head, male plates very short and broad, only slightly protruded beyond the valve. Female segment not entire, central portion wanting and segment represented only by lateral curved lobes extending from each side about half way to median line.

Type of subgenus *Curta alta*, DeLong & Caldwell, n. sp.

KEY TO SPECIES OF SUBGENUS CURTA.

1 Golden yellow in color, male style forming abruptly pointed apex, terminal caudal portion of oedagus rather long and narrow............*alta*

1′ Yellowish green in color, male styles branched near apex forming an outwardly and dorsally directed apical spine and a long, heavy dorsally directed spine; terminal caudal portion of oedagus broad and blunt at apex............*sitka*

Dikraneura (curta) alta, n. sp.

Resembling *mali* in general appearance but bright yellow and with distinct genitalia. Length 4 mm.

Vertex bluntly angled, one-third wider between eyes than length at middle, anterior half of pronotum fitted into the concavity of the vertex. Elytra long and narrow.

Color: golden yellow, elytra subhyaline, veins yellow.

Genitalia: Female last ventral segment similar to *sitka*, not entire but represented only by lateral curved portions, which extend about half way from either side to mid line of segment. Male plates very short and broad, separated at base, proximal at apex, with tips blunt and pointed inwardly. Style long, broadened before apex then strongly convexly curved on inner margin to form abruptly pointed tip. Oedagus very broad with lateral processes arising from outer margins of apical portion. In lateral view the apical portion is broad, the lateral processes curving caudally and another portion ventrally. The basal portion is also broad with a dorsal and a ventro-anterior projection. Spine of pygofer wanting.

Described from five male and five female specimens collected at Gillette, Penna., Aug. 30, 1922, by Prof. J. G. Sanders and the senior author. Male holotype, female allotype and male and female paratypes in collection of the senior author.

Dikraneura (curta) sitka, n. sp.

In general form resembling *robusta* but with different genitalia. Length 4 mm.

Vertex bluntly angled, almost rounded, in male more than twice as wide between eyes as length at middle, pronotum more than twice as long as vertex. The vertex of the female is twice as wide as long.

Color dull yellowish green, unmarked.

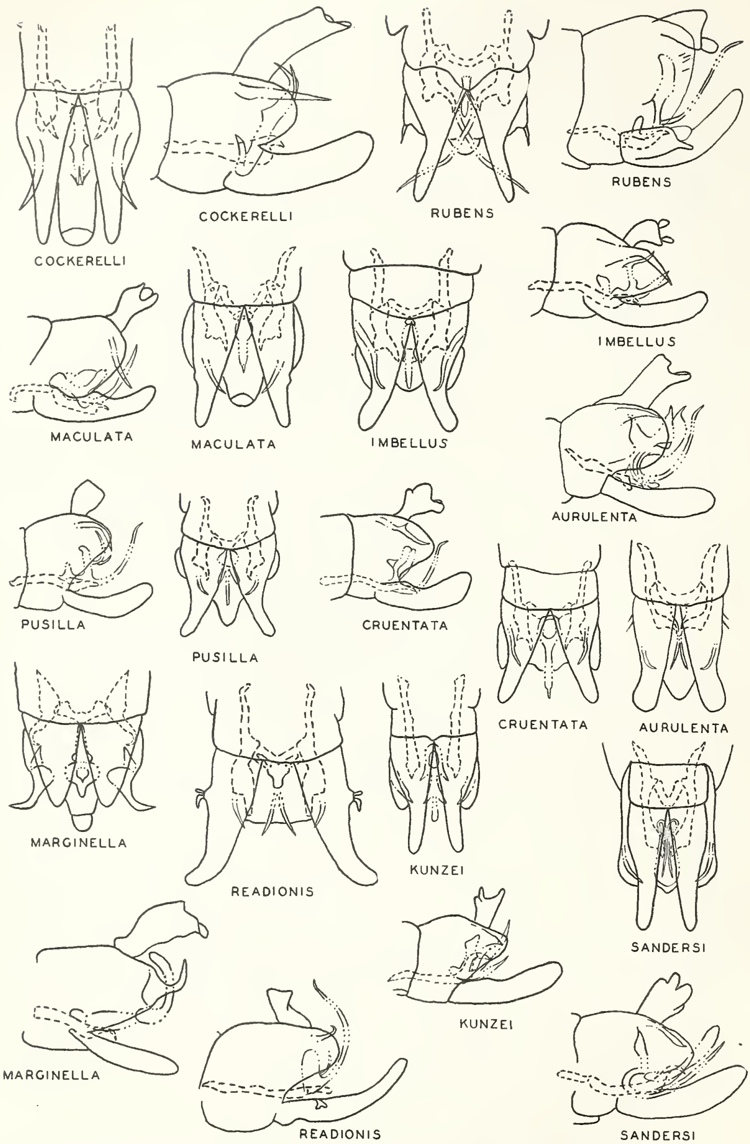
Genitalia: Female last ventral segment not entire, represented only by a lateral rounded lobe on each side, which extends about half way from the lateral margin to the middle of the segment.

Male plates broad and very short, separated at base, bluntly pointed and proximal at apex. Styles very long, narrow at base, broadened gradually on apical half, deeply roundedly notched on inner margin just before apex, then convexly curved on outer margin to form an outwardly and dorsally directed apical spine and a long heavy dorsally directed spine just before apex. Oedagus with a single terminal process and widely separated laterally curved bifurcate processes at about the middle. The terminal process extends caudally and is blunt at apex. The laterally diverging portions at the middle are narrow and extending dorsally and caudally, the single basal process is broad and shorter, extending almost dorsally.

Described from one male and five female specimens col-collected at Katmai, Alaska, by Prof. J. S. Hine, Aug. 15, 1917. Male holotype and female allotype in collection of senior author, paratypes in Herbert Osborn collection.

Explanation of Plates 1, 2 and 3.

Ventral and lateral views of ninth segment of male abdomens showing the internal genital structures in situ.


COCKERELLI
COCKERELLI
RUBENS
RUBENS
IMBELLUS
MACULATA
MACULATA
IMBELLUS
AURULENTA
PUSILLA
PUSILLA
CRUENTATA
CRUENTATA
AURULENTA
MARGINELLA
READIONIS
KUNZEI
SANDERSI
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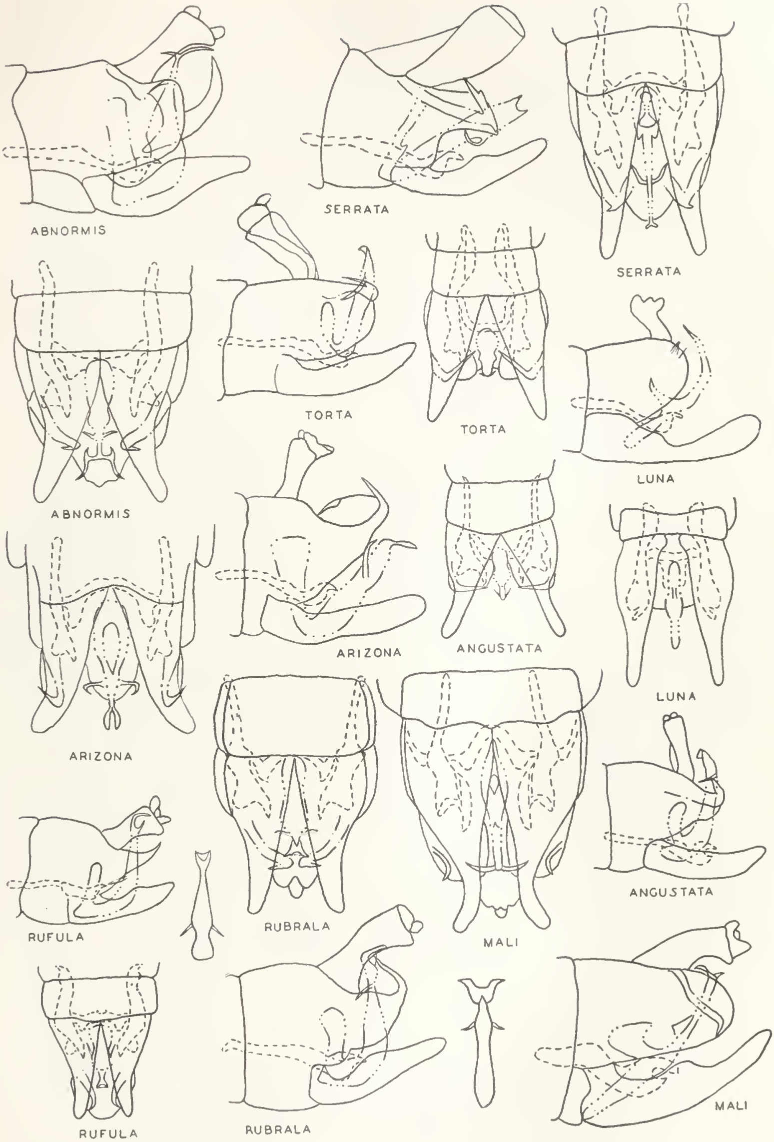
ABNORMIS
SERRATA
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TORTA
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LUNA
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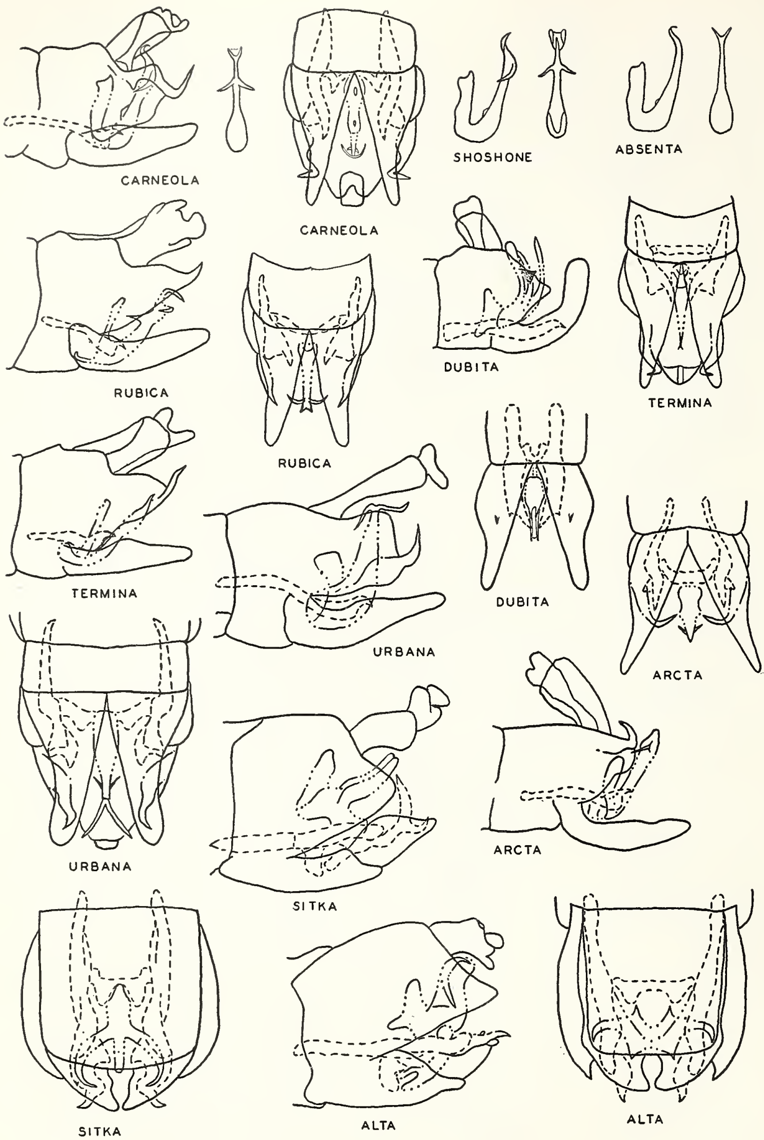
CARNEOLA
CARNEOLA
SHOSHONE
ABSENTA
RUBICA
RUBICA
DUBITA
TERMINA
TERMINA
URBANA
DUBITA
ARCTA
URBANA
SITKA
ARCTA
SITKA
ALTA
ALTA

MINUTES OF THE 479TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

The 479th regular meeting of the Society was held at 8 P. M., Thursday, January 7, 1937, in Room 43 of the Natural History Building of the National Museum. Thirty-four members and twelve visitors were present, with N. E. McIndoo presiding. The minutes of the previous meeting were read and approved.

On request from the chair, Dr. Ewing read the audited Treasurer's report, which was then accepted by the Society.

Miss Colcord, Chairman of the Membership Committee, presented the name of Wallace Coleman of Beltsville, Md., who, upon recommendation of the Executive Committee, was unanimously elected to the Society.

Under Notes and Exhibition of Specimens, E. A. Back showed specimens and drawings of *Tortelia viatrix* Busck. As evidence of how easily new pests can be distributed, Dr. Back called attention to the first appearance of the species in this country in September, 1933, when it was discovered in a warehouse in Hoboken, N. J., infesting senna (Cassia) leaves. After fumigation, a portion of the consignment was shipped in 1934, without Federal permit, by water to Charleston, S. C., and thence by rail to Chattanooga, Tenn. On storage in Tennessee, heavy infestation developed during 1934–35. Fumigation conducted in 1935 apparently eradicated the pest as no living specimens have been observed up to December, 1936. (Author's abstract.)

The chair announced the appointment of Mr. E. H. Siegler and Miss Grace Sandhouse as members of the 1937 Program Committee, and stated that the third member would be appointed in the near future.

Reports on annual meetings in Atlantic City in December, 1936, were made as follows: Entomological Society of America, by R. E. Snodgrass; American Association of Economic Entomologists: Apiculture, by W. J. Nolan, and the General Session by J. W. Bulger.

Upon invitation from the chair, the following visitors introduced themselves to the Society: W. E. Dove, San Antonio, Tex.; R. A. Blanchard, Urbana, Ill.; Robert Glen, Saskatoon, Sask.; C. B. Keck, Honolulu, T. H.; A. H. Madden, Amherst, Mass.; Miss Margaret Poor, Ames, Iowa. Mr. A. C. Baker greeted the Society, and discussed briefly his work on fruit flies in Mexico.

Dr. S. B. Fracker presented the address of the evening, as retiring president, on "Technique of Large-scale Pest Control Operations." Since this paper is to appear in a later number of the Proceedings, no abstract is given at this time.

The meeting adjourned at 10.00 P. M.

CATHERINE FORD,
Recording Secretary.

REPORT OF THE SUBCOMMITTEE OF THE EXECUTIVE COMMITTEE OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON ON FINANCES FOR THE YEAR 1936.

The following report on the finances of the Society for the year 1936 contains some data included in the report of the Corresponding Secretary-Treasurer for the calendar year 1936

to the Executive Committee at its regular meeting on January 5, 1937.

The year 1936 has been a prosperous one for the Society. In addition to the usual revenues received, $272.50 was collected on old debts, a dividend of $114.55 was received from the closed District National Bank and $67.23 was obtained from the sale of old exchange literature and donated publications. Income of this type, which totaled $454.28, can be collected only once. Without it, the publication of a full volume in 1936 would probably have left not more than $50.00 as a favorable balance in the treasury. A report on the receipts and expenditures for the calendar year 1936 follows:

RECEIPTS

Cash on hand	$108.16	
Dues from members	516.95	
Received from subscribers	756.23	
From authors for separates	230.00	
Sale of back numbers of Proceedings	119.10	
Sale of exchange and donated literature	67.23	
Donation	5.16	
Dividend from District National Bank	114.55	
Collection on overpayment	.09	
Collection on '35 Calif. voucher, less amount of '36 Calif. voucher not collected, less exchange on checks	39.86	
Net receipts		$1,957.33

EXPENDITURES.

To H. L. & J. B. McQueen, Inc., for printing Proceedings (Nos. 8 and 9 of Vol. 37 and Nos. 1–8 of Vol. 38) and separates	$1,248.68	
To Southern Engraving Co. for engravings	109.06	
Refund for overpayment	.85	
Deposit at Post Office	2.00	
Stationery	17.30	
Light bulbs	.60	
Postage	46.79	
Total expenditures		1,425.28
Cash on hand		$532.05
Outstanding obligations		None

PUBLICATION FUND

The publication fund of the Society consists of two items:

Schwarz donation, principal	$1,000.00
Schwarz donation, accumulated dividends from 1927 to 1936	493.60
Knab bequest; now covered by a five year personal, non-interest bearing note	1,400.00

H. E. EWING, *Chairman.*

NOTICE OF CHANGES IN RULES GOVERNING ILLUSTRATIONS AND GRATIS COPIES OF THE PROCEEDINGS.

Beginning with the March, 1937, issue of the Proceedings of the Entomological Society of Washington, there will be in effect certain changes in the rules governing illustrations and gratis copies of the Proceedings. These changes are made in pursuance with the action taken by the Executive Committee of the Society at its meeting of February 10th, 1937, and are described as follows:

In the past the Society has followed the practice of furnishing gratis to authors of "leading articles" ten copies of the particular numbers in which their articles were printed. This practice is now abolished and in its stead the following rule was adopted: "Authors will be furnished not to exceed 10 copies of the number in which their articles appear at a charge of 25 cents per copy."

Formerly the Society has permitted authors to publish, in any one article, without charge, an unlimited number of text figures or in lieu of this one full page line plate. A new rule regarding this was adopted and is as follows: "Authors will be furnished gratis with not to exceed two text engravings of line drawings with any one article, or in lieu thereof, with one full page line plate. Half tone engravings at author's expense, the same will be sent to author upon request after publication. Authors may purchase any published engraving at one-half the cost of manufacture thereof."

These rules will be in effect with the publication of the March issue and with all manuscript not already accepted on February 15th, 1937. —*Editor.*

NOTICES OF NEW BOOKS.

"Insect Wonders of Australia," by Keith C. McKeown, Assistant Entomologist, Australian Museum. 12 mo. cloth, 252 pp., 31 illus., Sydney, Australia, Angus and Robertson Ltd., 1936. 6/–.

Issued in binding and format similar to Alec C. Chisholm's "Bird Wonders of Australia," and Keith C. McKeown's "Spider Wonders of Australia" and other recently published books within that series, this little volume consists of a popular presentation of its subject matter likewise comparable in scope and in interest with its companions, and like them deals with perhaps some of the most curious and most interesting little creatures to be found anywhere. Long renowned for its unique animal life, it would be expected that Australia's insects likewise would occasionally assume exceedingly weird forms and take on unusual habits. Treated sympathetically by a writer having a background of technical museum knowledge as well

as a wide experience as a field naturalist in that country, its subject-matter appears to be not only well authenticated, but is of equal attractiveness to the nature student and to the general reader. Some idea of general scope of contents may be gained by an enumeration of some of the more striking of the subject subdivisions: Strangeness of the insect world; Child slavery among the ants; Living honey pots; Lions of the ants and the aphids; Carpenter of the grass-trees; Users of the saws; The world of the fig insects; Luminous insects—Fireflies and glow worms; Perfumed butterflies; Insect case-bearers; Curious cocoons and their makers; Life in the trees; Workers in secret—The Termites; Insect deceivers—Stick and leaf insects; A bush ogre; Curiosities of grasshopper life; Ways of Crickets; Strangeness of insect courtships; A singer in the sun; Assassin of the Cicada; Insect prisoners—the gall makers; Insect aviators, and, very appropriately, an exceedingly informative chapter on insect foods of the Australian aborigines. The value of the author's own text has been much increased by numerous illuminating quotations from other writers ranging from Pliny to Waterhouse, while the numerous carefully selected illustrations are stories within themselves and add greatly to the general attractiveness of the book. —J. S. W.

"An Introduction to Entomology," by John Henry Comstock, formerly professor of entomology and invertebrate zoology in Cornell University. 8th ed., rev. by Glenn W. Herrick. Large octavo, brown buckram, 1044 pp., frontispiece port. of author, 1228 figs., bibliog., Ithaca, N. Y., Comstock Pub. Co., 1936. $5.00.

Within the past few weeks there has appeared from the press a new eighth edition of this well known entomological classic which contains noteworthy and carefully prepared revisions by Dr. Glenn W. Herrick of Cornell. Since the general scope and arrangement of subject-matter of the previous editions of this work are well known to practically all the entomological fraternity, it remains in this notice merely to indicate wherein this particular work differs from its latest predecessor, issued in 1924 and commonly identified as the green buckram edition.

It will be found in this most recent edition that the class Myrientomata of Berlese has been advanced to its more logical position as the order Protura of Silvestri, under the Hexapoda. According to Dr. Herrick, this has been done with some mental reservation, but it has been deemed in accord with the trend of opinion among morphologists and probably most systematists. Probably the data for treating the suborder Entognatha of the Thysanura as a definite order are more numerous and more reliable than for the change in the position of the Protura. Out

of respect, however, for the careful conservatism of Professor Comstock, the Entognatha has been retained as a subordinate group in the Thysanura. Concerning this, Dr. Herrick adds: "This is, no doubt, illogical, because Professor Comstock always kept pace with legitimate progress in his field of science." The Hemimeridae has been advanced to its place in the Dermaptera and the suborder Idiogastra has been abandoned and the family Oryssidae has been included among the Chalastogastra.

—J. S. W.

The Biological Control of Insects with a Chapter on Weed Control, by Harvey L. Sweetman, Assistant Professor of Entomology, Massachusetts State College. 8 vo. cloth, 461 pp., 142 figs., Ithaca, New York, Comstock Publishing Company, Inc., 1936—$3.75.

This, the first American work on the subject designed as a text book for school use, seems certain of a hearty welcome from students and teachers of entomology and zoology. It is frankly a review of the literature of the subject, integrated and arranged for class work but it includes far more than a mere discussion of the insect parasites and predators of insects, as it embraces the entire field from the bacteria to the vertebrates. To quote the author's preface, "The manuscript follows a definite plan of presentation, treating first of the lower forms of life that are or show promise of being useful in the biological control of insects." Thus the various chapters embrace such titles as "The Theoretical Basis of Biological Control; The Use of Resistant Hosts; The Use of Microrganisms,—Bacteria and Fungi-Viruses and Protozoa; The use of Parasitic Invertebrate Animals; The use of Predatory Invertebrate Animals; Some Biological Relations of Insect Parasites; The Introduction of Insect Parasites and Predators; Factors to be considered in the Use of Insect Parasites and Predators; The use of Predatory Vertebrate Animals; Results of Biological Control Experiments Against Animals; and The Biological Control of Pest Plants." A brief glossary and a well arranged index conclude the work.

In the evaluation of a work of this character a fair criterion is the manner in which it meets the question of whether it is found to attain the purpose for which it was designed, rather than whether it constitutes a complete compendium of the subjects included within the field of survey. Judged by such a standard the work seems excellent. It is obvious that no single human intellect is capable of comprehending fully all of the vast fields of knowledge that are, in many cases, merely epitomized in its chapters. For instance the subject of parasitism and predacity by insects alone, is almost fathomless and could

be adequately exposed only through the collaboration of the foremost students of that most intricate of subjects. Such a treatment would be entirely out of place in the present volume.

Criticism may be evoked by the almost complete absence of quotation marks or the typographic indication of extensive matter often quoted verbatim. However, as the sources of such information are listed alphabetically by chapters at the conclusion of the text proper, this seems to be sufficient acknowledgment of the debt.

The author's conception of the meaning of such terms as symbiosis, mutualism, commensalism, etc., will doubtless evoke considerable and beneficial discussion.

The illustrations are well chosen but sometimes marred by extreme reduction or enlargement. The typography and format are excellent.

One case of what might humorously be termed "ultra-metamorphism" occurs in which the author by a stroke of the pen (or perhaps a click of the typewriter) has transformed the Mormon cricket into the "white grub" as the insect pest that menaced the crops of the followers of Brigham Young at Salt Lake in that memorable spring of 1848. Seriously speaking, however, this is merely a minor blemish that serves to emphasize the general excellence of the work as a whole. The Foreword is by L. O. Howard and the frontispiece is a fine and recent photographic portrait of him.

W. R. WALTON.

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PROCEEDINGS OF THE
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TECHNIQUE OF LARGE-SCALE OPERATIONS IN PEST CONTROL.[1]

By S. B. FRACKER,
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While entomology as a science is at least 200 years old, and while economic entomology in this country has a history covering a century or more, coordinated pest-control projects involving large numbers of persons have largely been a development of the last 20 years. In fact, more rapid strides in the methods of organizing and executing such work have been made during the last decade than in any previous period.

It happens that the speaker's responsibilities in the fields of entomology and plant pathology have been almost entirely in this branch of pest control, and it accordingly seems appropriate to attempt to review at this time the features that distinguish organized large-scale projects having a general public interest from the type of control measures which the private grower or land owner can apply himself and which are purely voluntary.

Thus far textbooks in entomology and phytopathology have largely neglected this field, partly, perhaps, because it is so new and partly because projects of this type are usually so extensive that the organization and methods of operation are determined with great care and after a good deal of study by those who have had considerable experience along these lines. Students in entomological courses, accordingly, are not likely, until several years after graduation, to be faced with the necessity of working out more than the minor details of such control programs.

THE PROBLEMS INVOLVED.

When a program is undertaken involving the total eradication of an insect pest or a plant disease, its state-wide control, or the prevention of its introduction or spread, the problems

[1] Address delivered by the retiring President of the Society at the January, 1937, meeting.

involved are not merely enlargements or multiple replications of the control measures that would be applied by the individual property owner for the protection of his own crops or property from loss from the pest concerned. The differences in program are fundamental. Information regarding the pest concerned must be elaborated with much greater precision and the methods of control are likely to be of an entirely different type.

It is necessary that such programs fulfill the following three basic requirements not involved in ordinary insect-control measures: First, the exact distribution of the pest must be determined; second, the administrative organization must deal satisfactorily with large numbers of property owners, as well as with others who may be deriving no direct benefit from the control operations or may even be suffering loss from the required measures; and third, the program must not only protect a given area from loss but must have a marked effect on the total population of the organism, resulting either in its complete extermination or in the destruction of such numbers as to affect materially the future development of the organism as a species or its geographical distribution. The ordinary entomological or phytopathological experiments are not well adapted for working out the difficult features of any of these three fundamental objectives. Let us look at each in turn in more detail.

MAKING DISTRIBUTION SURVEYS.

No matter how devastating an insect or a plant disease may be where it occurs in large numbers in the center of the outbreak area, the determination of the outside boundaries of its geographical distribution is a difficult task. Up to a few years ago almost the only measures available were those that would be employed by the taxonomist or botanist in building up his collection, that is, persistent search with the aid, perhaps, of light traps. The knowledge of distribution gained by this means is so inadequate as often to be of little use in any undertaking in which either extermination or prevention of spread is involved. At the same time the organization of close surveys and searches over a wide extent of territory by men examining the individual plants is so laborious and expensive that this feature alone has caused the abandonment of otherwise promising control campaigns. Uncertainty as to the actual geographical distribution of certain pests and realization of the cost and difficulty of carrying out adequate surveys are probably the deciding factors governing policies relating to quarantine or other measures against them. Cases in point include the hairy-

vetch bruchid (*Bruchus brachialis* Fahr.) (*1*)[2] and the tomato pinworm (*Gnorimoschema lycopersicella* Busck) (*9*).

On the other hand, among the undertakings in which the economic importance of the insect appeared to justify extensive expenditures for surveys of this type have been the suppressive or quarantine measures directed against the Mediterranean fruitfly, the Mexican fruitfly, the pink bollworm of cotton, the gipsy moth, the Japanese beetle, and the European corn borer. In connection with each of these projects in years past, there have been organized surveys, farm by farm, township by township, and county by county, in which large numbers of employees made laborious and prolonged searches for the pest concerned, going from plant to plant for the purpose. This method, in addition to its expense, has two other serious disadvantages. The examination of any large proportion of all the cornstalks, or fruit, or rose blossoms, or cotton bolls in any extensive area is out of the question, so no matter how extensively such a job may be undertaken it is, in effect, only a sampling process, and a light infestation might easily be passed over. Moreover, the scouts making the survey are only human, and when day after day, and in some cases week after week, pass without a single trace of infestation being found, it is probably impossible to maintain a sufficiently high morale to insure the close attention required for efficient work of this kind.

Fortunately there have recently been a number of developments that have tremendously increased the efficiency, intensification, and extent of coverage of such surveys. All of them are based on attempts to concentrate the pest population of a given area so that the points of examination can be reduced, and thereby much larger territory can be covered than would otherwise be possible.

One of the most interesting of these devices is the gin-trash machine developed by R. E. McDonald and his associates to increase the efficiency of scouting for the pink bollworm. It is described (*14*) as follows: "For a number of years it has been recognized that the trash which accumulates in the ginning of cotton furnishes a very favorable place to detect the presence of pink bollworms within the field where the cotton was produced . . . The machine (developed to simplify the examination of such trash) consists of two revolving drums which take out the large pieces of trash. The remaining part is passed through a current of air which removes all fine particles and leaves a residue containing only that part of the trash which is of the approximate size and weight of the pink bollworm. This residue falls on a continuous belt and can be quickly examined

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[2] Italicized figures in parentheses refer to the literature citations at the close of the paper.

by the inspector." The machine so concentrates the infestation that in a few hours the operator can find specimens of the pink bollworm in areas where it is so extremely scarce that many weary weeks of search in cotton fields would fail to turn it up. Such findings of very minute infestations are essential to the completion of most total-eradication projects, since the overlooking of any individuals whatever may mean future increase of the pest and renewed trouble and expense. The eradication of the pink bollworm infestation in the Salt River Valley (Arizona) several years ago might have proved an interminable task if it had not been for the prompt discovery of the few remaining traces of the pest in such gin-trash examinations and the immediate inauguration of suppressive measures in the places where they were most needed. According to Mr. McDonald the use of this machine reduces the cost of scouting to 2 per cent of the former expense.

Most other concentration devices are based on the principle of traps luring the insects to points where they can be examined. In the case of the gipsy moth, the scent given off by certain glands of the female abdomen attracts the males for distances of from half a mile to 2 miles (*3*). Cages are accordingly set out in areas suspected of having an undiscovered infestation, and these cages are baited with extracts of the body wall of the tip of the female abdomen. Many gipsy moth infestations have been discovered as a result of finding males collected at cages in the barrier zone, thus making possible the prompt application of extermination measures.

In a similar way the use of traps baited with geraniol and eugenol (*8*) has almost entirely displaced scouting as a method of discovering new Japanese beetle infestations. During the past summer 103,500 such traps were operated in over 300 communities outside the quarantined areas. In each case many new points of infestation have been located which would undoubtedly have been overlooked under a house-to-house scouting plan.

The Mexican fruitfly control project uses traps on both sides of the Rio Grande, the Mexican officials cooperating heartily in the work. These traps are baited with brown sugar and water. Their attractiveness is so strong that stray fruitflies are caught in citrus groves long before an infestation is built up which could be detected by inspection of the fruit.

Closely related to these measures for determining the distribution of insects is the use of alternate-host indicators in the case of plant diseases. For example, the pines infected with white pine blister rust distribute aeciospores which cause infection on *Ribes* leaves in considerable quantity for from 5 to 10 miles, and to a lesser degree for much longer distances. Such infected *Ribes* are occasionally picked up more than 100 miles from

sources of infection. The number of aeciospores produced is so great that thousands of *Ribes* leaves over considerable areas may be infected from a very few pine trees. The method of scouting for new blister rust locations is consequently that of examining the leaves of currant and gooseberry plants. Comparatively extensive cross-country surveys may thus be made, and intensive examination of the pines is required only after infection is picked up on *Ribes* in a new locality. The center of heaviest infection is found in this manner, and the search for diseased pine may then be confined to a very limited area.

Similarly, the locations of undiscovered barberry plants have been traced by observing grain-rust damage, searching for its center, and intensively surveying the vicinity for barberries.

On the other hand, some pest-control projects involve the eradication of species of stationary plants which give off no spores and release no insects to be trapped or to be found by indicators. For example, the Bureau is now engaged in Florida in a struggle to find and destroy every possible wild cotton plant, since it may harbor a surviving pink bollworm. In Arizona another group is exterminating *Thurberia* plants to wipe out the Thurberia weevil. In Georgia and other Southern States wild seedling peach trees are the object of intensive search by the organization charged with control of the phony peach disease, while in the Gulf Coast district in Texas the discovery of the plants of *Citrus trifoliata* growing wild on the islands and near the bays and lagoons along the coast has become essential to the success of citrus canker eradication. It seems at times almost hopeless to undertake these tasks on highways or on foot, and airplanes fly too fast and too high for carrying out the work satisfactorily, although they were used to discover outlaw cotton fields in non-cotton zones in Texas as early as 1918 (*12*).

The solution of such problems seems to depend on new developments in aviation technique. The most promising equipment for this purpose is the autogiro which the Bureau has recently been trying out, as it can be flown close above the tops of the trees and be made to hover over doubtful areas as long as necessary. Large numbers of isolated wilting elms have been detected by autogiro scouting on the Dutch elm disease project. By this means, also, small escaped areas of *Citrus trifoliata* have been discovered which could perhaps never have been located in any other practicable manner, and thus the eradication of citrus canker has been greatly aided. A film (*10*) showing the use of autogiros for estimating Japanese beetle damage was issued by the Department in 1934.

SECURING UNIFORMITY OF ACTION.

When the limits of geographical distribution of a pest have been found, the next problem is how to insure uniform and efficient action over large areas involving diverse elements of human population. In dealing with such common pests as cabbage worms, the Colorado potato beetle, the codling moth, the Mexican bean beetle, the plum curculio, apple scab, white grubs, wireworms, oat smut, and a multitude of other insect pests and plant diseases with which entomologists and plant pathologists are working from day to day, the objective is to determine what measures the individual owner or operator can apply himself to protect his own product from damage. In such cases the owner usually has only a secondary interest, if any, in whether his neighbor adopts the same or other measures of control. In fact, such control methods are usually based on the assumption that there is, in the general locality, an almost inexhaustible supply of the insects or fungi concerned and the object is to keep the organism from damaging a particular crop. Only rarely and under special economic conditions does the public, through Federal, State, or local governments, enter such a picture. There are a few exceptions, the most extensive being chinch bug control and grasshopper poisoning, where many farmers were not in an economic position to carry out such protective measures promptly and effectively and the crop values involved were sufficiently large to be a matter of public interest. These projects were therefore undertaken under the direction of the Federal and State governments, partly as an agricultural relief measure and partly for the preservation of the public food supply.

In nearly all other large-scale control campaigns the insects or plant diseases concerned are those which the individual property owner can not himself control. Without public action in such cases, he is, therefore, a victim of whatever conditions either the general public or his immediate neighbors are responsible for. In these cases recourse to educational measures is essential. We shall not pause to discuss such work in this paper, as its technique is that of agricultural extension methods in general. In pest-control measures, as in other public programs, it is essential to have the support and cooperation of the main body of the general public, or at least of the producers of the crop involved, and steps must be taken to ensure their understanding the object of the work proposed. In many cases involving the destruction of plants or material of economic value, compensation is provided as a matter of justice and equity and in recognition of the fact that valuable private property should not be taken, even for public good, without such compensation. Where there is popular interest and

support, however, it has been found that such compensation has rarely been demanded. For example, in most of the New England States more than 95 per cent of the persons having cultivated currant plants are sufficiently public-spirited to sacrifice them for the general good without compensation, when the object of the work is explained.

Nevertheless, in spite of the great good that can be accomplished through education and persuasion, it further becomes necessary, if complete uniformity of action is to be obtained, to take advantage of the fundamental principle of government that the public interest transcends that of private individuals. We therefore have the introduction of the law as one of the factors of every large-scale undertaking in pest control. The public with which investigators and extension men deal includes largely owners who are, or can be, interested in the measures proposed and whose action, if any, is entirely voluntary. In pest-control campaigns, however, it is often necessary to deal with, or work through, every resident of the territory concerned, with all their diversity in intelligence, economic conditions, and interest in, or indifference to, the crop to be protected.

The pest-control statutes of the Federal and State governments must therefore be so drafted that the necessary control or eradication measures may go forward in spite of possible indifference or hostility of a certain fringe of the population. The drafting of such laws involves a special technique which has developed as the result of considerable experience and study. The statutes of New York, Pennsylvania, Wisconsin, and California seem to be the result of a particularly careful effort to include all the necessary authority. The important features are to ensure that all the needed powers of access, inspection, treatment, destruction, and quarantine are specifically authorized. A mere authorization to the administrative body "to take such measures as may in its judgment be necessary" has been held by the courts to be insufficient to justify and legalize regulatory orders. Where the needed specific authority is granted, however, the statutes themselves and the orders issued under them have been upheld by Supreme Court decisions as not contravening either the "due process" clause of the Constitution or that clause which forbids the taking of private property for public use without compensation (*4*, *5*). The statute does not, of course, attempt to prescribe what action shall be taken to control a particular insect, but it must authorize the *kinds* of action the State or Federal regulatory body may find it necessary to employ.

MEASURES DIRECTED TOWARD COMPLETE EXTERMINATION.

Total eradication has been undertaken only in recent years and in a limited number of instances. It involves quite a different point of view and a different type of suppressive action from the control measures which are the ordinary subject of entomological and phytopathological research. Locating and exterminating the last hundredth of 1 per cent of the insect, or fungus, or species of plant requires a very different procedure from that of eliminating 90, or 99, or even 99.9 percent of the pest population.

The basic principle here involved is, I believe, a matter that has not been before expressed in so many words but has been tacitly recognized in all successful eradication programs. It is this: *To accomplish eradication, more stringent action must be taken than can be demonstrated at the moment as necessary.* In other words, the plans must provide for a wide margin of safety in the areas covered, the period of continuing suppressive measures, and the degree of enforcement of such measures. Doubtful points must be decided on the side of greater stringency. This is essential even after we have completed a survey and appear to have a close idea of the distribution of the pest, and after an investigation has indicated what seems to be necessary to exterminate it in the individual plants. I believe all those who have been directly connected with eradication projects will agree with me that unless this is done the plan adopted, although appearing to meet the needs of the situation and to be ideal from the standpoint of expense and the minimum sacrifice of plants, would almost never be successful.

Perhaps this point can be made especially clear by an illustration. In the case of the Mediterranean fruitfly in Florida, the minimum requirement might have been considered to involve the destruction of all fruit on the infested trees or on the infested property in order to destroy the fly larvae, and the use of a poisoned bait spray on this property and perhaps also on those immediately adjoining. The measures actually used were the destruction of all fruit growing *within a mile* of the infested property and the use of poisoned bait sprays over protective areas which extended *a distance of 10 miles* from the infested property. The apparently successful termination of that tremendous job was, we may be sure, due to the willingness to carry out these needed measures over a wider area than the known infestation apparently required.

A like situation exists at the present time with respect to the Dutch elm disease. The Federal and State Governments and the property owners might continue indefinitely to cut down infected trees, and each year there would be more to cut down. Whether the attempt to exterminate this fungus from the

United States will be successful, is, of course, not yet known, but if that result is finally accomplished it can be credited to the public's willingness to sacrifice the more than 3,000,000 unhealthy and weak elms on which the disease would continue to spread. It is the extermination of these marginal and doubtful trees, with an observed infection of scarcely more than 1 percent, which is the most important feature of the Dutch elm disease campaign, and the measure to be credited with success if that is ultimately achieved.

In the same way the extermination of the pink bollworm of cotton in eastern Texas, as well as its apparent more recent eradication in Georgia and in the Salt River Valley of Arizona, can be credited to a willingness to face the necessity of noncotton zones and the destruction of cotton plants throughout the infested areas and for a border zone around them—in other words, the necessity of going beyond the immediate and most pressingly apparent needs of the situation. Permanent results in the eastern part of the Cotton Belt apparently will depend on continuation of the program for destruction of wild cotton in southern Florida until, through host elimination in that section, the centers of pink bollworm infestation there have completely disappeared.

Similarly the country's most expensive failure to complete an eradication campaign was due to a lack of recognition of the need for persistence after the program had first appeared to be successful. When, in 1900, the legislature of Massachusetts refused to continue the gipsy moth eradication program as recommended by Dr. Fernald, it was because the larvae had become so scarce they were no longer troublesome. The abandonment of the work for four years resulted in the pest's gaining so firm a foothold that the State and its citizens have since been expending over a million dollars a year merely to alleviate the trouble. The extra margin of safety was not provided, the additional months of eradicative effort were not expended, and the opportunity of permanently stamping out this serious woodland pest was lost, perhaps forever. In the more recent projects of this kind against other insects, the need for this margin of safety has been recognized, and the work continued month after month until all possibility of survival of the pest seemed to be exhausted.

While this situation is, of course, well recognized in the Bureau and in the Department, the general public will probably never have a full realization of it. For example, even persons who appreciate the accomplishments of the Mediterranean fruitfly eradication work have been known to say, "Of course, mistakes were made from time to time in conducting it, but the results were successful." When pressed for details as to mistakes, they usually refer to inclusion in the quarantine of potential host

plants which were later found to be uninfested in Florida, and to other measures which either proved to be unnecessary or were of doubtful value. They do not realize that the success of the Mediterranean fruitfly work can be attributed almost entirely to willingness to go farther than the minimum immediate needs of the situation, and that, if all measures not definitely known in advance to be absolutely necessary and effective had been eliminated from the program, the Mediterranean fruitfly would still be a serious citrus pest in Florida.

In the measures used in the field to bring about the total extermination of an insect pest, a plant disease, or some noxious form of vegetation, there has been a rapid development during recent years. In fact, many of the measures being used with effective results and to a considerable extent in the field appear never to have been described in the literature, though reference has been made to most of them in office reports, Bureau news letters, and other informal documents available to those particularly interested.

One such unique measure was that used in attacking the parlatoria date scale in the date gardens of Arizona and California. When spraying and fumigation proved unsuccessful in accomplishing complete eradication, a more drastic method of treatment was devised. "The treatment of an infested palm," according to B. L. Boyden, who was in charge of this work, "consists in removing all the exposed foliage except the terminal bud and running the flame of a gasoline torch over the leaf stubs . . . If the palm is in bearing, this causes the loss of fruit for about 2½ years (half a crop the third year). In many cases, however, the infestation is so light that cutting off a round or two of leaves will clean up the palm with no apparent loss of fruit. If the palm is of no particular value to the owner, it is dug out and destroyed."

In the case of most plant diseases, and even in some insect-eradication projects, it is impossible to preserve the infested plants in this manner. Here the eradication measures include the destruction of infected or infested host plants, and in many instances of the plants that have been exposed to infection or infestation as well. With citrus canker, the phony peach disease, and the Dutch elm disease, the destruction of the infected and exposed trees is the basic extermination measure employed.

A recent development along this line, and one which is still in its experimental stage, is the introduction into the sap stream of the infested trees of chemicals poisonous both to the insects concerned and to the trees. Where both insects and fungi are involved, as in the Dutch elm disease, the ideal plan would provide a chemical which killed the insects, the fungus, and the tree all at the same time. As stated in a press notice (*13*)

issued by the Department of Agriculture on November 11, 1936, the chemicals now being successfully employed for this purpose include zinc chloride and copper sulphate. The former is recommended in the case of trees to be cut into lumber, since its use does not involve a corrosive action on nails as do copper salts. When this method is used on small trees, the tree is cut off at its base and the base of the trunk is set in a pail of the solution. With trees too large to be treated in this way, the bark is removed from around the base, a notch is sawed through several layers of the wood in the center of the smooth strip, and a wide rubber band is stretched around the notch. The solution is then run under the band and into the notch. Concentrations of 1 pound of the powdered chemical in one-half gallon of water for each cubic foot of wood in the tree have proved satisfactory. the solution is taken up in less than a day and its distribution into all parts of the sapwood occurs within 5 to 10 days. The press notice mentioned refers to the use of this method with pine, spruce, fir, oak, hickory, and yellow poplar, but it is also being experimentally employed in a Dutch elm disease project. In the case of elms, copper sulphate crystals (so-called "copper sulphate snow") are being used under the bands, instead of the chemical in solution.

Where annual plants such as potatoes and cotton are involved, the economic loss attending the destruction of the plant itself is small, particularly if the crop can be utilized before the plants are destroyed. Here however, soil sterilization may be involved, and this constitutes a difficult problem. In the case of potato wart, the possibility of sterilizing the soil by means of either formaldehyde or mercury compounds was worked out a number of years ago, but these materials were so expensive that their use on a large scale seemed prohibitive. For several years the State of Pennsylvania has been trying on a commercial scale the use of ammonium thiocyanate for soil sterilization and has been finding it effective and much less costly than other materials or methods tried. Thus far, however, it has been employed solely in outlying infestations where only a few gardens are involved, since the sterilization of the central infested area of several thousand acres would still be an expensive undertaking.

As regards a number of insect pests, no practical method of eliminating an infestation from the soil has been worked out, although the matter has been the subject of extensive tests in the case of the alfalfa weevil, the European corn borer, and the Mediterranean fruit fly. Fire applied to the surface in various ways has been tried rather extensively, but it seems impossible to get the heat from open flames into the ground to a sufficient distance to kill insects, even those that are close to the surface. Soil sterilization by a steam-pressure method, however, has

been effective on a small scale in eliminating fungi, bacteria, weed seeds, insects, and nematodes.

Mechanical and chemical destruction of the insects, fungi, or other organisms, or host plants are not, however, the only measures available for the total eradication of infestations, and less direct measures can sometimes be employed. The most common of these is starving or preventing the breeding of the insect through eliminating host plants or fruit for periods of varying length. This method has been most extensively used in the case of noncotton zones maintained for eradication of the pink bollworm. It has proved effective in Texas, Arizona, and Georgia, when employed over periods of 1, 2, or 3 years, and when combined with the necessary associated measures it has met with apparently complete success in the Salt River Valley of Arizona and in Georgia and eastern Texas. It is not being employed in western Texas, New Mexico, or southeastern Arizona because this area is subject to continuous reinfestation from the infested cotton-growing sections of Mexico. A combined noncotton zone for parts of Mexico and the United States, however, has been considered. A general noncotton program throughout the entire Cotton Belt has also been discussed as a possible measure for the eradication of the boll weevil. The principal obstacles are the questionable practicability of accomplishing the destruction of all cotton plants for a year throughout such a tremendous area, and the economic problems involved in temporarily eliminating the most important source of livelihood from an extensive region in which millions of people would be affected.

A host-free period maintained for about 5 months each year is used in the suppression of the Mexican fruitfly in the Rio Grande Valley in southern Texas. (*15*). During this period the development of any host fruits to such a size and age that the Mexican fruitfly could breed in them is prevented entirely or as nearly so as is humanly possible.

LARGE-SCALE CONTROL MEASURES.

Where the extermination of an insect pest or plant disease is impracticable, it is often possible to accomplish some benefit to the general public through large-scale control measures. Such projects are undertaken by governmental agencies where an important public interest is involved and where the individual property owner can not well apply the most promising control methods. In such undertakings the measures employed are quite different from those used when the aim is complete extermination of the insect or fungus.

The so-called biological method, usually involving the introduction of parasites, provides perhaps the ideal means of

accomplishing such large-scale control. In addition this measure seems to have a particular appeal to public fancy. The use of parasites, as is well recognized, is of no value when complete extermination is being undertaken, but it is perhaps the most important of all possible procedures when an attempt is being made to establish a balance of nature and to eliminate the necessity of using artificial methods of control for an indefinite time.

One artificial control method used extensively in combating the diseases of plants, animals, and man is the destruction of alternate hosts. Barberry plants are thus killed to control black-stem rust of grains, *Ribes* bushes are pulled out of pine stands to suppress white pine blister rust, rats are exterminated in cities to eliminate the bubonic plague, and ticks are destroyed with chemical dips to exterminate the Texas cattle fever. All these are pest-control measures which must be handled through public agencies.

Each of these projects involves the solution of a series of technical problems. For example, the *Ribes*-eradication method adopted in the control of white pine blister rust is dependent on the number and species of *Ribes* present. Pre-eradication surveys are therefore required. The *Ribes* are then destroyed either by hand-pulling or by spraying with sodium chlorate mixtures, or by decapitating and then treating the stumps with Diesel oil, ammonium thiocyanate, or borax. Similarly, barberry bushes are killed in various ways, depending on local conditions. Barberry plants sprout so readily from root fragments that digging is employed only for ornamental plants. Rock salt placed about the roots of plants without disturbing them is the most common method now employed. During the past season 3,929 tons of salt have been so distributed on barberry bushes. In the case of native species of barberries, such as *Berberis fendleri* in Colorado and *B. canadensis* in Virginia and West Virginia, the plants are sprayed and the soil is drenched with either Diesel oil or a mixture of sodium chlorate and calcium chloride (8 pounds to 5 gallons of water to each square rod).

The possibilities of such alternate-host programs in insect control have been inadequately explored. Perhaps the most extensive work along that line has been done in combating the beet leafhopper, where the method has been used more for forecasting outbreaks than for outright control, and in the *Thurberia*-eradication program now being carried on in Arizona for eliminating or controlling the Thurberia weevil. Further consideration can well be given by entomologists to other possibilities in this field.

Entomologists, however, have contributed very extensively to the development of other kinds of special technique for large-scale campaigns for pest control. Methods of high-power

spraying (*2*, *19*) and airplane dusting (*7*) of woodlands and cotton; dusting, oiling, and other measures used for mosquito control; and special large-scale organizations worked out for grasshopper and chinch bug control are only a few of the methods available for use on such public cooperative projects although scarcely at all adaptable to use by the individual producer.

PREVENTION OF SPREAD.

Another phase of pest-control work with which the individual producer is wholly unable to cope is the prevention of spread of an insect from one continent or section to another. The measures adopted to accomplish such prevention of spread are of two classes (1) the establishment of barrier zones in which clean-up operations are centered, and (2) the promulgation of quarantines. The first of these is used to prevent cross-country spread through natural flight or wind distribution. The best known, and perhaps the only markedly successful, large project of this type has been that dealing with the gipsy moth (*2*), in which a zone 30 miles wide has been established to prevent the moth from spreading westward out of New England. The setting up of such zones should be, and to a limited extent is, accompanied by attempts to keep the insect under control in the adjoining areas, as otherwise continuous and heavy re-infestation of the zone itself becomes a serious problem.

In the case of quarantines, the most important recent developments are the new treatments that have been worked out to prevent commercial products from carrying infestation into new localities. This is another field that was almost unexplored ten years ago, and marked success has attended the search for such methods. The problem has been especially difficult where the shipment of living plants and nursery stock was involved, but even here many methods have been found which are highly effective. The methods of applying heat, fumigation, and treatment of the soil employed to prevent nursery stock from carrying the Japanese bettle to new localities are described in detail in orders issued under the provisions of the Japanese beetle quarantine regulations (*16*).

Other new developments include the fumigation of bulbs with sodium cyanide to prevent bulb fly infestation, hot-water treatments for various bulbs and other plants to eliminate nematodes, and similar treatments in the case of imported chestnuts infested with weevils and *Laspeyresia splendana*.

An important mechanical device developed by the Federal Horticultural Board for use in preventing spread of an insect from one country to another is the equipment employed in vacuum fumigation (*11*). The vacuum chambers are used

largely for the fumigation of cotton imported into the United States from other countries or produced in a section of the United States infested with the pink bollworm. As originally designed, hydrocyanic acid gas was generated through the use of sodium cyanide and sulphuric acid and admitted to the vacuum chamber after the vacuum had been established. Air was then introduced to force the gas into the cotton bales. More recently tanks of liquid hydrocyanic acid have been employed by certain commercial cotton-fumigation plants. Study has been given to the relative advantages and disadvantages of introducing air during the fumigation period, and a publication discussing the results of these investigations is under preparation in the Division of Control Investigations.

An interesting mechanical device used in eliminating insects from food supplies is the beetle separator (*6*), through which beans produced in certain sections of New Jersey are run to eliminate Japanese beetles.

One of the most important lines of investigation still under way for the purpose of killing insects in food products without harming the products is the use of refrigeration. This method is useful with products that can be subjected to a slightly lower temperature for a given period than the insect attacking it can survive. It is one which should have pronounced economic effects, for its use will make possible the production of fruit in areas lightly infested with such insects as the Mediterranean fruitfly for safe shipment into the United States and other countries not so infested. This method was brought into use during the Mediterranean fruitfly campaign in Florida, and is still employed, when occasion requires, in the area in southern Texas quarantined on account of the Mexican fruitfly (*18*). Fruits that may have been exposed to infestation but are not known to be infested are treated by "cooling until the approximate center of the fruit reaches a temperature of 30° to 31° F. and holding the fruit at that temperature 15 days." This plan has the advantage of being usable at ordinary commercial cold-storage plants or possibly on shipboard under proper control, and when worked out for the various insects and plant products to which it is applicable it promises to come into general use.

Heat treatments that take advantage of the differential resistance between the product and the insect are also available but require special equipment. For citrus fruits the air must be saturated with moisture throughout the period of treatment, and special methods of providing the necessary saturation and temperature have been worked out. In the case of the Mexican fruitfly program in Texas, the heat treatment (*17*) has been an alternative to the refrigeration method. The treatment authorized consists of "heating the fruit to a temperature of 110° F.

or above (not to exceed 112°) in the approximate center of the fruit and holding the temperature . . . for a period of eight hours."

Heat is also used extensively in preventing the pink bollworm from surviving in cotton seed. Where the seed is to be used inside the regulated areas, the heat is applied as a part of the continuous process of ginning, but if it is to be shipped to uninfested territory the seed is held for one hour at 145° F. in a steam-jacketed container.

In addition to heat, sterilization, mechanical separation, and fumigation, pressure can also be used for eliminating insect infestation from commercial products such as cotton.

For a number of years the pink bollworm quarantine (Notice of Quarantine 52 as revised) has made provision for the use of pressure to destroy any insects which might be present in cotton bales. This is the measure usually applied just before shipment, and in its commercial form it came into use to decrease the volume occupied by the cotton bale in freight cars and thereby to reduce the cost of transportation. When the pressure applied is sufficient to crush any seed contained in the bale, any bollworm infestation that may be present is destroyed. During recent years special equipment has sometimes been used which provides for passing the cotton in the form of a bat between heavy steel rollers held together by heavy springs (*6*). This is used as part of the ginning operations, and where it can be employed in this way it has been much less expensive than the ordinary commercial compression.

CONCLUSION.

The technique of campaigns for large-scale pest control is a field in which practice has outdistanced theory and in which methods have come into extensive use long before being described in the literature or being taught in entomological courses. Practically none of the procedures and measures mentioned in this discussion are described in textbooks of entomology or plant pathology, and most of them are not even referred to. For this reason considerable difficulty has been experienced in preparing a list of citations of literature relating to these programs, processes, and methods of organization. References will be found to some of them only in Bureau news letters and office reports of very limited distribution.

Nevertheless, they have come into very extensive practical use, and as a matter of fact more than 25,000 persons have been employed during the past summer in carrying out the various methods and processes mentioned in this paper. Large-scale pest control is a science or an industry that has had phenomenal growth. It is a part of the new recognition by the present

generation that there is no need of suffering the losses and disasters of a harmful and annoying environment—that the injurious and damaging factors of our surroundings are in most cases subject to control if we have the ingenuity to work out the proper methods and the initiative to adopt and apply them.

The control and extermination of extensive insect and plant-disease infestations and infections have taken such an important place and are involving the employment of so many graduates of our agricultural colleges and universities that teaching of this field in such educational institutions should no longer be neglected. The control measures now taught in entomology and plant-disease courses are largely those that can be applied by individual producers, namely, spraying, plowing, maintaining proper storage conditions, seed treatments, soil sterilization, etc.

On the other hand, hundreds of the graduates, on leaving school, find themselves engaged in inspection, vacuum fumigation, extermination of noxious plants and alternate hosts, drafting or administering quarantine laws and regulations, setting traps, checking crew results, making maps, making infestation surveys along compass lines, and playing other parts in a great protective program carried out for the public through Federal, State, and other governmental agencies. The students should receive more training in these fields and gain more of a conception of what is going on in them.

In this paper the writer has attempted to classify and arrange in some orderly fashion the features of pest-control projects adapted to large-scale public use. In undertaking future work of this kind, the administrator will have a much larger body of experience to fall back on than ever before. This greatly enhances the chance of success. The technique of large-scale operations for pest control and eradication is taking its place among the great scientific developments of the present generation.

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Lawrence Bruner

In Memoriam

LAWRENCE BRUNER.

Resolved, that the following be adopted and entered in the minutes of this society, March 4, 1937.

The Entomological Society of Washington has lost by death one of its few remaining charter members, Lawrence Bruner.

In the death of Professor Bruner American Entomology has lost a pioneer from its ranks, one who contributed much to the field of Economic Entomology and who greatly extended our knowledge of the Orthoptera through his painstaking studies. Nebraska has lost one of its staunchest citizens whose stimulating influence did so much toward improving the welfare of the people.

We extend our most sincere sympathy to his bereaved relatives and his many friends.

We recommend that a sketch of the life of our late member be prepared and published in the Proceedings of the Society.

Signed: H. G. Barber, *Chairman.*
Ashley B. Gurney.

LAWRENCE BRUNER.

By H. G. Barber and Ashley B. Gurney.

Lawrence Bruner, for nearly 50 years Entomologist at the University of Nebraska, died at Berkley, California, January 30, 1937.

He was born at Catasauga, Lehigh County, Pennsylvania, March 2, 1856. When he was only six months old his parents moved to a farm near Omaha, then, in 1870, the family joined the early pioneer group that founded West Point, Nebraska. It was at West Point that his first paper on Orthoptera, published in 1876, was written. In 1880 he became Assistant to the U. S. Entomological Commission in connection with the grasshopper investigations and under the direction of the late C. V. Riley was one of the first entomological explorers of several areas of the Northwest where the only means of transportation was by stage, boat or on horseback. In 1888 he was appointed Entomologist of the Nebraska Experiment Station and Entomological Field Agent of the U. S. Department of Agriculture. In 1890 he became Instructor and in 1895 Professor of Entomology at the University of Nebraska, which position he held, with more or less extended leaves of absence, until 1931. He was President of the American Association of

Economic Entomologists in 1900. In 1915 the Governor's Council named him the most distinguished Nebraskan and appointed him as representative of the State at the Panama Exposition. After 1915 he spent a great deal of time in California, gradually relinquishing his duties at the University of Nebraska and becoming Professor Emeritus in 1931.

As a pioneer American orthopterist of major rank, Professor Bruner was preceded only by S. H. Scudder and Cyrus Thomas. His investigation of the Rocky Mountain Locust stimulated his early interest in Orthoptera and he specialized in the Acrididae. His appointment in 1897 to the Commission studying the destructive grasshoppers of Argentina led to his notable reports published in 1898 and 1900. He was author of that portion of the Biologia Centrali-Americana dealing with Acrididae proper. He also contributed numerous papers on North and Central American Orthoptera and in later years broadened the scope of his studies to include exotic Gryllidae and Tettigoniidae. Among his last studies were a contribution to African Orthoptera in 1919 and a preliminary catalogue of Philippine Island orthopterous insects in 1915. Major parts of the extensive collections studied by him are located in the Carnegie Museum at Pittsburgh, the Hebard Collection at Philadelphia and the University of Nebraska Collection at Lincoln. His library on Orthoptera was given to the University of Nebraska in 1933.

As a teacher Professor Bruner will be remembered by his many students who enjoyed his congenial companionship both in laboratory and far afield at a time when Entomology had few good teachers in the Middle West. As State Entomologist his far-reaching knowledge of Nature in general, and of insects and birds in particular, provided the background for many excellent reports and several notable treatises on insect pests. The people of Nebraska will remember him, not only for his scientific attainments, but also for his quiet modesty and helpful cooperation.

In 1881 Professor Bruner married Marcia Dewell, of which marriage two daughters now survive him.

A NEW BAT-CAVE BUG FROM PANAMA (HEMIPTERA-HETEROPTERA : REDUVIIDAE).

By H. G. Barber,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

CAVERNICOLA, new genus.

Body ovate. Head porrect, ovate, mutic, longer than the pronotum, very convex dorsally, pre- and post-ocular regions nearly subequal in length; eyes not strongly projecting; ocelli not elevated, rather obscure, widely separated,

situated in the cervical groove behind the eyes. Antennae inserted much closer to the eyes than to the apex of the head; antenniferous tubercles mutic, shorter than the length of an eye. Rostrum moderately slender, straight, apposed to the ventral surface of the head; second segment much longer than the very short basal and terminal segments. Pronotum mutic, much wider than long, lateral margins rounded dorso-ventrally, neither impressed nor carinate; the transverse sulcus well marked, placed well before the middle; anterior lobe strongly declivous in front, divided longitudinally by a deep, median sulcus; collar distinct, with a slight anterior tubercle at each side; posterior lobe with two slightly elevated, widely separated longitudinal carinae; entire posterior margin convexly rounded, the edge distinctly, narrowly margined. Scutellum wider than long, with disk strongly elevated, apically provided with a short, blunt, slightly recurved spine. Hemielytra with membranous clavus; veins of corium obsolete; membrane with two elongated cells arising from the apical margin of the corium, the one nearest to the apical angle of the corium extended farther caudad. Connexivum narrowly expanded. Venter convex, neither flattened nor carinate. Legs elongate, all femora moderately but distinctly incrassate, mutic; anterior pair somewhat shorter than the other two pairs; tibiae straight, devoid of spongy fossa apically, as long as or, in the case of the posterior pair of legs, longer than the femora, devoid of spines but with long hairs; tarsi long and slender, first segments very short, terminal two nearly equal.

Type of the genus: *Cavernicola pilosa*, new species.

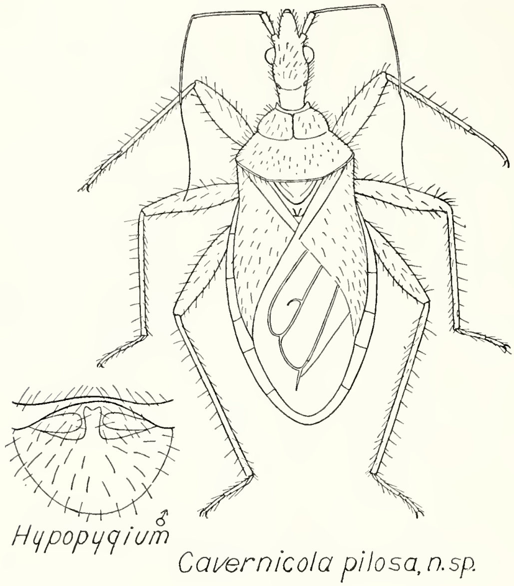
This genus apparently is not closely related to any known member of the Triatominae, to which it undoubtedly belongs. It agrees with the genus *Triatoma* in having an elongate, porrect head, in the position of the eyes, and in the point of insertion and character of the antennae as well as in the structure of the rostrum and its position in relation to the ventral surface of the head. *Cavernicola* differs from *Triatoma* chiefly in the more ovate shape of the head, in the character of the pronotum and scutellum, in the absence of veins in the corium, in the incrassate femora, in the elongate tarsi, and especially in the pilosity of the body and appendages.

Cavernicola pilosa, new species.

Dull, covered with sparse long hairs. The following parts piceous: Head, pronotum, and scutellum. The following parts heavily infuscated: Antennae, femora except at bases, tibiae, corium except the central disk, which is testaceous, membrane except the testaceous veins, connexivum, pleura, sterna, and the venter broadly on either side of the middle region. The following parts yellow-testaceous: Coxae, trochanters, bases of all femora, broad central disk of the venter. Rostrum and tarsi ferruginous brown.

Head elongate, ovate, sparsely long pilose, dorsum strongly convex transversely and also longitudinally to base of tylus, where it is distinctly impressed; preocular region but little shorter than the postocular. Antennae inserted much closer to eyes than to apex of head; preocular margins slightly flaring to

apex of antenniferous tubercles, which are mutic; tylus parallel sided; postocular margins gently rounded and slightly converging posteriorly towards collum; dorsum with a strongly arcuate transverse groove which begins at the upper



posterior region of the eyes; ocelli small, indistinct, widely separated, situated in the cervical groove well behind the eyes. Antennae pilose, with short, mostly inclined hairs, and with a few scattered, longer, erect hairs; basal segment not quite reaching apex of head, somewhat more incrassate than the second segment, which is about three times as long as basal, third and fourth segments much more slender than the basal two, third segment about one-third longer than second, fourth segment nearly one-fourth longer than third. Rostrum extending to just behind base of head, with numerous very short, erect, fine hairs; first and third segments short, second segment about four times as long as third. Pronotum sparsely long pilose; anterior lobe strongly, convexly elevated on either side of the deep, median, longitudinal groove; posterior lobe obsoletely wrinkled; humeral angles bluntly rounded, not at all projecting beyond costal margins. Legs long pilose, with both oblique and nearly erect hairs, some of those on the tibiae much longer than the width of that segment. Corium with long hairs; veins obsolete; costal margin gently, concavely arcuated towards base, thence gently rounded to apex. Membrane very nearly reaching apex of abdomen, the inner or shorter cell often having a short transverse intracellular vein arising from the median vein. Connexivum narrowly exposed, unicolorous, pilose; abdomen towards apex with several long hairs. Prosternum devoid of a distinct longitudinal groove so characteristic of *Triatoma*. Venter smooth, with long pile; connexivum narrowly exposed below; spiracles situated but little closer to the lateral than to the anterior margins of the segments.

Hypopygium of the male with a rather stout, erect process which is slightly forked at apex; lateral appendages clavate, rather stout. Length 11–13 mm.; humeral width 3.5 mm.

Type male, U. S. N. M. Cat. No. 51977, Madden Dam, Canal Zone, Panama, 1936, in Chillibrillo bat caves. Paratypes: 2 males, 5 females, and 5 nymphs with the same data as the type. Collected by Dr. Lloyd E. Rozeboom, Gorgas Memorial Institute of Tropical and Preventive Medicine.

As these specimens were taken in caves frequented by great numbers of bats, it seems very probable that they are predators on the bats.

EUPTEROMALUS LEGUMINIS, NEW SPECIES (HYMENOPTERA : PTEROMALIDAE).

By A. B. Gahan,
Bureau of Entomology and Plant Quarantine,
United States Department of Agriculture.

The species of *Eupteromalus* offer very few positive characters for differentiation. The present species is extremely similar to *americanus* Gahan and also very close to *sarcophagae* Gahan. Males of the new species differ from those of both *americanus* and *sarcophagae* by having the wings much abbreviated, rarely extending much beyond the apex of the abdomen. The females differ from *americanus* females by having the antennal pedicel, ring joints, and first funicle joint longer, by lacking entirely any wavy lines or other sculpture on the second abdominal tergite, by having the median carina on the propodeum somewhat more strongly developed, and by having the alveolate punctures on the scutellum smaller and more irregular in shape. Females of *sarcophagae* agree with those of the new species in the absence of any sculpture on the second tergite, but otherwise differ in antennal, sculptural, and propodeal characters about as do females of *americanus*. The new species is further distinguished from *sarcophagae* by having at the apex of the scutellum about five or six transverse rows of alveolate punctures which are distinctly coarser and deeper than those elsewhere on the scutellum.

Female.—Length 3 mm. Head slightly wider than thorax at tegulae, viewed from in front about one-fifth broader than high, alveolately sculptured, the alveoli rather small, more or less compressed and irregular in shape; clypeal area very finely striated; malar groove absent or subobsolete; occipital carina distinct and much below the vertex; postocellar and ocellocular lines equal or very nearly so; face moderately receding below. Antennae inserted nearly on a line with the lower extremities of the eyes; scape reaching to front ocellus, subcylindrical; pedicel one-third as long as scape, about three times as long as

its apical width; first ring joint about twice as broad as long, second fully as long as broad, fully as broad as pedicel and sculptured about like the funicle joints; first funicle joint one-third longer than broad and distinctly broader than pedicel, together with the ring joints distinctly longer than pedicel; second funicle joint distinctly a little longer than broad; third, fourth, and fifth joints about as long as broad; sixth very slightly broader than long; club 3-jointed, scarcely broader than funicle, and a little longer than two preceding funicle joints together.

Thorax rather robust, alveolately sculptured; mesoscutum fully twice as broad as long, the alveoli small and more or less irregular in shape, those on the posterior median portion somewhat larger and deeper than elsewhere; parapsidal grooves traceable to a little beyond middle of mesoscutum; scutellum broad, about equal in length to the mesoscutum and with similar sculpture except that the alveolate punctures are somewhat more distinctly compressed, and at apex of scutellum are about six irregularly transverse rows of distinctly larger, deeper, and more nearly round alveoli; propodeum approximately two-thirds as long as scutellum, with a strong median carina, well developed and complete lateral folds, and a very distinct apical neck which is set off from the rest of the propodeum by a deep constriction or furrow, the whole area between the folds with deep alveolate punctures, the surface laterad of folds a little more weakly sculptured especially between base of fold and spiracle, where it is nearly smooth; spiracles about twice as long as broad; sides of propodeum laterad of spiracles clothed with long pale hairs; pleura strongly sculptured except that a triangular area beneath the wings and the prepectal triangle are smooth. Legs normal. Wings fully developed, the fore wings extending a little beyond apex of abdomen; submarginal vein about three times as long as marginal; postmarginal a little longer than marginal; stigmal as long as marginal or only a little shorter, only slightly thickened toward apex, the stigmal knob slender and poorly differentiated, the stylus well developed. Abdomen pointed ovate, as broad as thorax and about as long as head and thorax combined; first tergite perfectly smooth, constituting a little less than half the length of the abdomen, slightly broader than long, bare except for a few hairs on the sides; second one-third to one-fourth as long as first and perfectly smooth; third and fourth shorter and also smooth and bare; fifth smooth but with a few hairs basally; sixth about as long as fourth, weakly reticulated and sparsely clothed with hairs over most of its surface; seventh triangular, about as long as sixth, weakly reticulated, the apex hairy; ovipositor concealed.

General color aeneous black; scape, pedicel, mandibles except apices, and legs except coxae dark reddish testaceous; flagellum black; coxae concolorous with thorax; abdomen shining black, the basal half of first tergite bluish or greenish; wings hyaline, venation dark testaceous. The propodeum laterad of the folds is usually tinged with brassy green and in some specimens the femora are dark brown. Vestiture whitish.

Male.—Length 2 mm. Antennae similar to those of female but a little longer; first funicle joint about twice as long as broad, following joints successively decreasing slightly in length, the 6th as long as broad; club not thickened and not so long as the three preceding joints combined. Wings variable in size, but apparently always much smaller than in the female, although usually extending

a little beyond apex of abdomen, the fore wing in allotype male 1.5 mm. in length. Abdomen in dead specimens greatly retracted apically, usually with only the first and second tergites visible; first tergite nearly twice as broad as long, perfectly smooth, polished and bare; second short, also polished and bare. Color and remaining characters as described for the female.

Type locality.—Corvallis, Oreg.

Type.—No. 52010, United States National Museum.

Described from 27 specimens all said to have been reared from *Bruchus pisorum* L. or from peas infested with that weevil. The type (female), allotype (male), 4 female paratypes, and 2 paratype males labeled "Corvallis, Ore., from weevils collected at Abraham's, Aug. 31, Sept. 30, and Oct. 30, 1931"; 4 male paratypes "Ex. *Bruchus pisorum*, Corvallis, Ore., 1931, F. G. Kinman collector"; 11 male paratypes "from weevily peas collected at Tracer's, Corvallis, Ore., July 20, 1931, emerged Aug. 31, 1931"; 2 female paratypes "Scio, Ore. Sept. 23, 1931, Clair Wilks coll."; 1 female paratype "Moscow, Ida., Aug. 15, 1931, altitude 2560 ft., C. Wakeland coll."; and 1 female paratype reared from pea weevil in laboratory, Moscow, Ida., 1932, T. A. Brindley.

The Museum collection also contains the following specimens which I am unable to distinguish in any way from the type series: 1 specimen from Salt Lake, Utah, Oct. 20, 1919, and 2 specimens from Upton, Utah, Oct. 31, 1919, all reared from *Bathyplectes* cocoons by T. R. Chamberlin under Salt Lake Laboratory No. 2407AAA; 4 specimens from Fallon, Nev., Sept. 7, 1932, reared from *Bathyplectes* by S. J. Snow under Sacramento No. 3287; and 5 specimens from Laramie, Wyo., said to have been reared from cocoons of *Hypera postica* (Gyll.) in 1927 by H. L. Sweetman.

In connection with the above records of this supposed new species from *Bathyplectes* cocoons, attention should be called to the fact that 12 specimens reared by C. J. Sorenson from *Bathyplectes* cocoons at Ft. Duchesne, Utah, in July, 1931, are in the National Museum collection and have been identified as *Eupteromalus americanus*, with which they appear to agree in every way. This fact seems to indicate a possibility that the slight differences distinguishing *americanus* from *leguminis* may not be really specific and careful biological investigations may eventually prove this to be true. In the absence of such proof it seems best to recognize the two forms as different species.

MINUTES OF THE 480TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

The 480th regular meeting of the Society was held at 8 P. M., Thursday, February 4, 1937, in Room 43 of the Natural History Building of the National Museum. Twenty-four members and eight visitors were present, with N. E.

McIndoo presiding. The minutes of the previous meeting were read and approved.

H. E. Ewing moved that the Society extend a vote of thanks to the retiring Corresponding Secretary-Treasurer, John E. Graf, for the very efficient manner in which he served the Society while in office. The motion was seconded and passed.

E. H. Siegler conveyed to the Society the invitation to hold its June meeting at the Beltsville Laboratory. The chair thanked Mr. Siegler for the invitation in behalf of the Society, and stated that the matter would be voted on at the next meeting. The Society voted to invite the Insecticide Society to join in the June meeting.

A. B. Gurney brought to the attention of the Society the recent death of Lawrence Bruner, a former member of the Society, and gave a short sketch of his life and work. The chair appointed H. G. Barber and Mr. Gurney to draw up an obituary notice to be published in the Proceedings.

J. A. Hyslop was appointed by the chair as the third member of the Program Committee.

Under the heading of "Notes and Exhibition of Specimens," Mr. Cushman exhibited specimens of apterous, subapterous and brachypterous Ichneumonidae, and discussed these conditions as they occur in the family. Reduction in size or absence of wings is most frequently confined to the female, although in the tribe Gelini many species have both subapterous and fully winged males, and a few species have males of both these forms and also brachypterous males. No entirely apterous male is known. In completely apterous forms, such as the female *Gelis* and *Thaumatotypidea*, the thoracic structure is highly modified as in the worker ant, and such forms bear a striking resemblance to ants; subapterous and brachypterous forms exhibit thoracic modifications somewhat in proportion to the degree of wing reduction. All the apterous and brachypterous forms recorded heretofore belong to the subfamily Cryptinae (Tribes Gelini, Stilpnini, Phygadeuonini and Cryptini); but among the specimens exhibited were a subapterous female of a specie of *Epitomus* (subfamily Joppinae, tribe Phaeogenini) and two brachypterous males of an apparently new genus allied to *Hyperacmus* (subfamily Tryphoninae, tribe Exochini), both exhibiting some reduction in the size of the wing-bearing segments. (Author's abstract.)

The first paper on the regular program, by Robert Glen, of the Dominion Entomological Branch Laboratory at Saskatoon, Sask., was on "The Wireworm Problem: Some Economic and Taxonomic Considerations." Since part of this paper is to be published in the Proceedings, an abstract is not included here. Discussion by Ewing, Siegler and McIndoo followed.

The second paper on the regular program, entitled "Controlling Honeybee Diseases," was postponed, due to Dr. Burnside's unavoidable absence from the city.

Dr. George Engelhardt, Curator Emeritus of the Department of Natural Sciences, Brooklyn Museum of Arts and Sciences, and member of the Brooklyn Entomological Society, brought greetings from that society, and discussed its history and publications. Adjournment followed at 10 P. M.

CATHERINE FORD,
Recording Secretary.

Actual date of publication, April 8, 1937.

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PROCEEDINGS

OF THE

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OF WASHINGTON

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THE

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OF WASHINGTON

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Annual dues for members are $3.00; initiation fee $1.00. Members are entitled to the Proceedings and any manuscript submitted by them is given precedence over any submitted by non-members.

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PROCEEDINGS OF THE

Entomological Society of Washington

VOL. 39 APRIL, 1937 No. 4

TEN NEW SPECIES OF WEST INDIAN CHRYSOMELIDAE (COLEOPTERA).

By Doris H. Blake.

The following new species are described for the most part from specimens collected in Cuba by S. C. Bruner and his associates, and from specimens collected in Haiti by P. J. Darlington. In addition a *Lactica* collected by Miss Perkins in Jamaica and a species of *Luperodes* from Porto Rico that has long been in the National Museum collection are described.

Metachroma gracile, n. sp.

(Pl. 5, Fig. 9.)

Elongate oval, about 6 mm. long, rather feebly shining, with strongly punctate prothorax and elytra; pale yellowish or reddish brown, the jaws and lateral margin of prothorax and elytra deeper brown.

Head densely and distinctly punctate, alutaceous between the punctures; a small depression on front; interantennal area without prominences. Antennae not extending to the middle of the elytra, joints 2, 3, 4, 5, and 6 about equal, remainder a little longer. Prothorax about a third wider than long, with rounded sides, the anterior and posterior angles sharply toothed; surface densely and distinctly punctate and also somewhat alutaceous. Elytra a little wider than prothorax, widest at about the middle, thence gradually narrowing to apex; humeri prominent, with a well-marked depression within, and particularly in female a slight lateral costa extending from humeri to apical narrowing, most marked at about the middle; punctation of the 12 elytral striae (not including the shorter scutellar row of punctures) distinct to the apex; intervals somewhat alutaceous and very finely and sparsely punctate. Body beneath alutaceous, abdomen punctate. Anterior and posterior femora with small but sharp tooth. Claws with a small basal tooth. Length 5.4 to 6 mm., width 2.4 to 2.7 mm.

Type.—Male, U. S. N. M. Cat. No. 51838.

Type locality.—Santiago de las Vegas, Habana, Cuba, collected in 1919, by "B. T. B." One other specimen, a female, is in the U. S. National Museum, collected at Buenos Aires, Trinidad Mts., Cuba, on 3 May, 1932, by J. Acuña.

This is an unusually long and narrow species of *Metachroma* which, instead of having oblong elytra as is usually the case in the genus, is widest near the middle of the elytra, thence tapering

gradually to the apex. It is also distinctive in being less shiny than most and the dense punctures of the head and prothorax as well as of the elytral striae are well marked.

Galerucella conjuncta, n. sp.

(Pl. 5, Fig. 2.)

Oblong oval, 3 to 4 mm. long, dark brown to piceous, finely and densely pubescent; lower part of head not so deeply brown, prothorax usually entirely pale but sometimes with small brownish areas in center and on sides, elytra with three pale, rather irregular stripes, more or less interconnected at various points, legs pale with brown rings in middle of femora and tibiae, the apices of tibiae and tarsi also dark.

Head densely pubescent above with a median vertical line, dark, with lower front a little paler, mandibles dark. Antennae piceous except the first three or four paler brown basal joints, not extending much below humeri, 3rd joint longer than 4th, remaining joints shorter and about equal. Prothorax scarcely twice as wide as long, widest a little before the middle, with a small nodule at basal angle; much depressed on sides and with a long median impression; covered with short thick pubescence; usually entirely pale, but occasionally with brownish areas in depressions on sides or middle. Elytra dark brown or piceous, densely pubescent, with close punctation showing somewhat beneath the pubescence; three rather irregular yellowish gray vittae on each elytron, the margin and suture dark; the first vitta parallel to suture, curving outwards towards apex and joining at apex with a median vitta, the third arising just below humerus, also joining the others at apex, the apex being more or less tipped with yellow; all these vittae showing a tendency to branch at right angles and connect with each other at various points, the outermost vitta being the most irregular and branching, the others often evanescent in part. Body beneath mostly dark; the legs pale with a dark ring about the middle of the femora and tibiae, the apex of each leg joint often dark. Length 3 to 4.2 mm. width 1.5 to 1.8 mm.

Type.—Male and 31 paratypes, U. S. N. M. Cat. No. 51839.

Type locality.—Port au Prince, Haiti, collected by G. N. Wolcott in March, 1925; also collected in the vicinity of the same city on 2 October, 1934, by P. J. Darlington, and at Diquini, Haiti, by W. M. Mann.

This species most closely resembles in elytral pattern *G. wolcotti* Bryant, described from San Juan, Porto Rico. That species, however, has 4 distinct vittae on each elytron, the sutural edges being pale. In the 2 specimens of *G. wolcotti* examined, there is no evidence of the cross branching of the vittae so typical of *G. conjuncta*. In *G. wolcotti*, moreover, there are transverse impressions across the elytra, one before and the other after the middle, which are wanting in *G. conjuncta*. *G. wolcotti* is paler, with paler antennae, each joint dark at the apex, and with paler legs, showing little trace of dark rings.

Diabrotica darlingtoni, n. sp.

(Pl. 5, Fig. 3.)

Ovate, very minutely punctate, shining black with pale yellow antennae, having joints 1–2 and 8–10 darkened (11th missing); prothorax pale and two irregular pale bands on each elytron, not quite joining across the suture. Length 9 mm., width 5 mm.

Head entirely shining black, a few fine punctures on front near eye, and a rather deep depression above tubercles, lower front with fine white hairs. Antennae not extending to the middle of the elytra, 3rd and 4th joints long, 4th longest of all, 5th and 6th thicker, remainder narrower and about same length, apical joints missing. Prothorax not twice as wide as long, with slightly arcuate sides and narrow explanate margin, smooth, entirely pale. Elytra moderately convex, ovate, shining, very finely punctate, humeri well marked and with an intrahumeral depression; black with pale yellow markings in the form of an irregular fascia before the middle and a wider one before the apex, these not quite joining across the suture. Body beneath and legs dark, prosternum pale; shining, with pale pubescence; coxal cavities open, middle and posterior tibiae mucronate.

Type.—Female, M. C. Z. No. 22370, in Museum of Comparative Zoology, Cambridge, Mass.

Type locality.—Kenskoff (near Port au Prince), Haiti, 4–6000 ft., collected 23 Sept., 1934, by P. J. Darlington.

This species closely resembles a Cuban species, *D. 4-guttata* Oliv., but has an entirely dark head, the head in the Cuban species being pale yellow from the antennal sockets upwards. It also differs from that species in having antennal joints of different proportions, the 4th joint in *darlingtoni* being about twice as long as the 5th. The last two joints in *4-guttata* are dark, whereas in *darlingtoni* the last 4 (presumably also the apical one, missing in the specimen) are dark. The prothorax of *darlingtoni* has more rounded sides, and the elytral punctation is not so distinct, being barely visible under high magnification.

Luperodes antillarum, n. sp.

(Pl. 5, Fig. 1.)

Elongate oblong, about 4 mm. long, shining dark blue, with deep brown or piceous antennae and yellow legs; thorax sparsely, elytra more coarsely and more densely punctate.

Head entirely dark blue or with an aeneous lustre, smooth over occiput, a row of coarse punctures above frontal tubercles and an impressed line between inner margin of eyes and tubercles; tubercles well marked, interantennal area slightly carinate. Antennae deep reddish brown or piceous, more robust in the male, fully half the length of the body, third joint shorter than fourth, fourth very little shorter than fifth, the others except the apical one about the length of fourth. Prothorax widest before the middle, about a third broader than long, with rounded sides contracted before base and with a small tooth at basal angle;

disc not very convex, faintly depressed before basal margin, shining dark blue, not densely but distinctly punctate. Scutellum rounded at apex. Elytra wider than thorax, with prominent humeri and narrow margin not extending to apex; more coarsely and densely punctate than thorax, the punctures subseriate and becoming less distinct toward apex. Epipleura not reaching apex. Body beneath dark, finely pubescent, legs pale. Anterior coxal cavities open, prosternum narrow between them, tibiae of all legs with short, very inconspicuous spur; the first tarsal joint of the posterior legs twice as long as the following joint. Length 3.6–4.8 mm.; width 1.8–2 mm.

Type.—Male and 41 paratypes, U. S. N. M. Cat. No. 51841.

Type locality.—Rio Piedras, Porto Rico, collected by R. T. Cotton 8 May, 1917, on *Jussiaea suffruticosa.*

This species of *Luperodes* resembles *L. meraca* (Say) very closely in shape and coloration, but is a trifle smaller, much more coarsely punctate and has a darker head and antennae, and the antennae are shorter and more robust. It more closely resembles the *L. meraca* group than the two species of *Luperus* (*L. placidus* Suffrian and *L. malachiodes* Suffrian) described from Cuba, which are smaller and more slender.

Lactica jamaicensis, n. sp.

(Pl. 5, Fig. 5.)

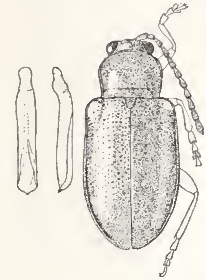
Oblong oval, about 3 mm. long, polished, very finely punctate; head, prothorax, body beneath and legs dark with blue or green lustre, elytra aeneous usually with rosy lustre, antennae piceous or deep brown, the basal joints frequently with blue lustre, tarsi reddish brown or piceous.

Head entirely dark, polished, very finely punctate, with obsolete frontal tubercles, a rounded interantennal area, and a deep fovea on each side of vertex near eye. Antennae fully half the length of the body, dark, often the basal joints bluish, apical ones paler brown or piceous; third joint shorter than 4th or 5th, which are subequal, the remainder a little shorter and about equal in length. Prothorax with arcuate sides, dark blue, shining, extremely finely punctate and with a deep basal sulcus limited at each end. Elytra oblong oval, in female a little wider behind the middle, but not at all ovate; humeri well marked, no basal callosity or depression before the middle; surface finely and more distinctly punctate than prothorax; polished, aeneous with a rosy lustre. Body beneath dark, often bluish or greenish, with fine, not dense, white pubescence; precoxal cavities open, prosternum and mesosternum moderately wide between the coxae; tarsi reddish brown or piceous, claws with a basal tooth. Length 2.6 to 3.5 mm., width 1.4 to 1.8 mm.

Type.—Male and 5 paratypes (2 males, 3 females), U. S. N. M. Cat. No. 51842.

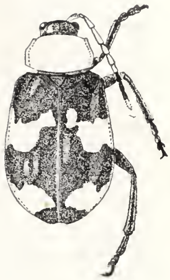
Type locality.—Jamaica, collected by L. G. Perkins.

This pretty species of *Lactica* appears to be distinct from the several species of somewhat similar coloring that have been

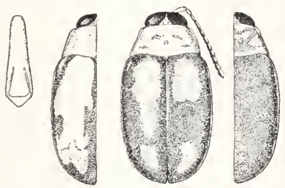


1. Luperodes antillarum

2. Galerucella conjuncta

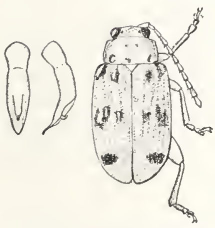


3. Diabrotica darlingtoni

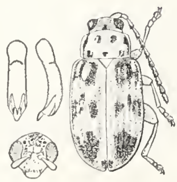


4. Megistops tabebuiae

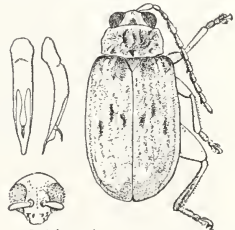
5 Lactica jamaicensis



6. Hemilactica 14-punctata?

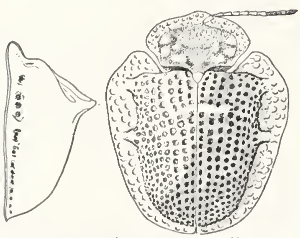


7. Hemilactica pulchella

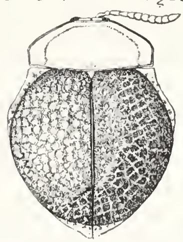


8. Hemilactica rugosa

9. Metachroma gracile



10. Paratrikona turritella



11. Elytrogona nigrodorsata

described, none of which is from the West Indies. *L. salvini* Jac. from Guatemala, with violaceous blue head and prothorax and cupreous violaceous elytra, differs by being entirely impunctate. *L. cupreata* Jac. from Mexico, black with metallic red elytra, is also entirely impunctate and the elytra differ by having a deep basal impression. *L. germari* Jac. from Guatemala, metallic blue in color, differs by being larger and more robustly ovate and has a basal impression on the elytra. *L. violacea* Jac. from Guatemala is obsoletely depressed below the base of the elytra. *L. coerulescens* Weise from South America, greenish blue, differs by having the basal antennal joints reddish yellow, and *L. flavipes* Weise from South America, aeneous green in color, differs by having yellow feet and antennae.

HEMILACTICA, new genus.

In his work on the Chrysomelidae of Cuba Suffrian[1] described in his section *F.* of *Haltica* two species, *H. stomachosa* and *H. 14-punctata*, which he was unable to place definitely in any other group of Halticinae. He included under *Haltica* the genera *Haltica*, *Disonycha*, *Systena*, *Crepidodera*, *Phyllotreta*, etc., distinguishing them as sections. He stated that in the sculpture of the elytra they resembled *H. costipennis* (*Disonycha conjugata* Fab.), but that in the sculpture of the thorax they reminded him of the *Monomacra* (*Lactica*) group.

Two species closely related to those described by Suffrian have been sent to me by S. C. Bruner, who collected both in Oriente Province, Cuba. Dr. E. A. Schwarz collected at Cayamas, Santa Clara Province, a third species, which agrees so closely with Suffrian's description of *14-punctata*, except in the color of the elytral spots (Suffrian described these as black, whereas in Schwarz's specimen they are distinctly bright blue), that I believe it is only a color variety of *14-punctata*.

These four species constitute a group that, as Suffrian remarked, does not fall readily into any genus of Halticinae. The characters of the group as given by Suffrian are "Body elongate, eyes distant. Thorax uneven, posteriorly transversely sulcate with the sulcus obsolete, marked by three deeper foveae. Elytra scarcely striate punctate, with interstices elevated. Posterior femora strongly incrassate, the tibiae externally sulcate with a very short spur, the claws widely dentate." It may be added that in all the head is coarsely and rugosely punctate and the antennae long, extending about to the middle of the elytra, with the 4th joint longer than the 3rd and 5th, and the succeeding ones gradually shorter. The prothorax is about twice as broad as long, narrowed a little anteriorly, with the anterior angles obtuse and the basal angles sharp. The disk is marked at the base by three foveae, the obsolete transverse sulcus, of which Suffrian writes, being practically invisible. The elytra in all the species are more or less marked by numerous costae. In the only female examined, the costae are more evident. There seems to be also a trace of striate punctation in *stomachosa* and in one of the new species here described. Beneath, the

[1] Suffrian, Archiv. f. Naturgesch., vol. 34, pt. 1, p. 204, 1868.

anterior coxal cavities are open, the hind tibiae have a tiny spur, and the claws are widely dentate at the base.

The markings of three species, *14-punctata* and two here described as new, are similar. All three have a dark occipital spot, frequently spots or bands on the pronotum, and similarly placed elytral spots. In the fourth, *stomachosa*, the elytra are blue with a pale margin.

This group of four species would undoubtedly fall into the large group named Lacticities by Chapuis on account of (1) the claws, which are not inflated, (2) the open anterior coxal cavities; (3 the pronotum which, although not marked by a profound basal sulcus, does have limiting lateral depressions such as occur at the end of the transverse sulcus in the genus *Lactica*. It differs from the two genera most closely related to it, *Lactica* and *Diphaulaca*, in not having a definite transverse basal sulcus on the prothorax. From *Lactica* it differs also in its rugose head, frequently uneven prothorax, numerous elytral costae and tendency towards striate elytral punctation. Unlike *Diphaulaca*, the elytra are not distinctly striate punctate in any species, although two species show traces of this. Harold differentiates *Lactica* from *Diphaulaca* by the obtuse, not produced anterior angles of the prothorax, which are acute in *Diphaulaca*. Suffrian's group resembles *Lactica* rather than *Diphaulaca* in having similar blunt anterior angles of the prothorax.

This group is probably endemic in the West Indies, and so far as now known, is confined to Cuba. *L. subcostata*, described by Jacoby from Mexico and Guatemala, may be a related species. Jacoby described the sculpture of the head and also the groove on the prothorax as being different from the other species of *Lactica*. On account of the differences here described the group seems worthy of generic distinction, and is given the name *Hemilactica*. The type of the genus is here designated as *Hemilactica pulchella*, one of the two species described in this paper, since the types of Suffrian's two species have not been examined by the writer, and only one of them tentatively identified.

Hemilactica pulchella, n. sp.

(Pl. 5, Fig. 7.)

Oblong oval, about 3 mm. long, shining, prothorax with three basal foveae, elytra somewhat costate; yellowish brown with a piceous spot on occiput, four piceous spots in a row across pronotum, and large spots with a blue or greenish lustre on elytra located as follows: two confluent ones at base of each elytron, two in the middle, a large one behind the middle, and a smaller one at the suture almost at the apex.

Head with the exception of a dark occipital spot yellowish brown; frontal tubercles well marked; interantennal area not much produced; interocular space about half the width of the head; vertex and occiput coarsely, densely and rugosely punctate. Antennae slender, extending fully to the middle of the elytra, dark brown with slightly paler basal joints, 1st and 4th joints longest, 3rd a little longer than 2nd, apical joints from the 5th gradually diminishing in length to the last. Prothorax not very convex, scarcely twice as wide as long, with rounded sides and narrow lateral margin; disk shining, distinctly and not densely or coarsely punctate, with three basal foveae, one in the middle

and one on each side, the lateral ones pronounced and resembling the ends of a sulcus such as is found in *Lactica* but with little trace of the transverse basal groove typical of that genus; pale yellowish brown with four piceous spots across pronotum anteriorly, the two outer ones extending to the lateral margin. Scutellum triangular. Elytra with narrow lateral margin, small humeral prominences, and with traces of costae, a little more pronounced in the female; distinctly punctured in the basal half, the punctures tending to become striate, punctation becoming obsolete towards apex; shining yellow brown with dark spots having a blue or greenish lustre, these spots arranged across elytra somewhat like bands; the first two at the base of the elytron, one covering humerus, the other a median spot, confluent with the first; two spots in the middle of the elytron, the outer one extending from the middle to the lateral margin, possibly representing two confluent spots of which the inner one is a little anterior to the outer, the innermost spot near the suture; behind the middle a very large spot, and near the apex a small spot common to both elytra. Epipleura not extending quite to the apex. Body beneath shining pale yellowish brown, lightly pubescent, anterior coxal cavities open, hind tibiae with a small spur, claws with a broad basal tooth. Length 3 mm., width 1.8 mm.

Type.—Male, and one paratype, female, U. S. N. M. Cat. No. 51835.

Type locality.—Jarahueca, Oriente Province, Cuba, collected in July, 1927, by S. C. Bruner.

This species disagrees with Suffrian's description of *H. 14-punctata* in its deeper, almost reddish brown coloration, spotted prothorax and bright metallic elytral spots, which are somewhat differently placed. It differs from the specimen tentatively identified by Dr. E. A. Schwarz and the writer as *14-punctata* in the same respects and also in the more distinct punctation of the elytra in the basal half, and in the greater convexity of the elytra. The aedeagus is also different.

Hemilactica rugosa, n. sp.

(Pl. 5, Fig. 8.)

Oblong oval, about 3.5 mm. long, upper surface very rugose with coarse, shallow, poorly defined punctures; eyes large, prothorax coarsely wrinkled and with three basal foveae, elytra uneven with irregular costae; reddish brown with a darker spot on the occiput, an irregular dark band across pronotum, and on each elytron dark infuscation on the humerus and median basal callosity, three transverse brown spots in the middle, and a faint trace of spot near the apex.

Head with large eyes, the interocular space being about one-third the width of the head; antennal bases closely set and between them a narrow, slightly produced carina; frontal tubercles well defined; vertex and occiput rugose with coarse, shallow punctures; except for a slightly darker spot on occiput, entire head deep reddish brown. Antennae slender, reddish brown, extending to the middle of the elytra, first and fourth joints longest, the third and fifth a little

shorter, and remainder gradually decreasing in length and becoming thicker. Prothorax twice as broad as long, not very convex, slightly narrowed anteriorly with a narrow margin; disk very uneven and coarsely wrinkled, at base with three well defined foveae, the two lateral ones deep and representing the limited ends of a basal sulcus such as occurs in species of *Lactica*, but the transverse part of the sulcus scarcely evident; reddish brown with a broad irregular dark band extending nearly across the disk. Scutellum large, smooth, triangular. Elytra with a narrow lateral margin, well marked humeri, and a basal callosity in the middle of each elytron; surface uneven with a suggestion of numerous poorly defined costae; very coarsely, shallowly and rugosely punctate; reddish brown with a darkening on the humerus and basal callosity, three small median spots, and in one specimen a suggestion of a spot near the apex of each elytron. Epipleura wide and extending nearly to the apex. Body beneath shining reddish brown with a fine pubescence, tarsi slightly paler yellowish brown; anterior coxal cavities open; coxae well separated; hind tibiae with a short inconspicuous spur; claws with a broad basal tooth. Length 3.5 to 3.8 mm.; width 1.8 to 2 mm.

Type.—Male and one paratype (male), U. S. N. M. Cat. No. 51836.

Type locality.—Palma Mocha, Sierra Maestra, Oriente Province, Cuba, collected in July, 1922, by C. H. Ballou and S. C. Bruner.

This species stands apart from the rest of the genus in its extremely rugose and coarsely punctate upper surface and its unusually large, closely placed eyes. Its relationship to *pulchella* and *14-punctata* is shown in the elytral spots, which, while not as distinct, are similarly placed. The only traces of the basal sulcus on the prothorax, the median and two lateral depressions, are rather easily overlooked in the very uneven surface of the pronotum.

Megistops tabebuiae, n. sp.

(Pl. 5, Fig. 4.)

Oval, somewhat convex, about 3 mm. long, alutaceous, not very shining, very finely punctate; color variable, head, prothorax and undersurface in two specimens yellow brown with suggestion of spotting on prothorax, third specimen deeper brown; elytra varying from mostly yellow brown with dark piceous suture and dark sides to entirely dark.

Head yellowish brown or darker, conspicuous for the large, nearly contiguous eyes and wide dark labrum; frontal tubercles well marked, a small fovea on each side near eye. Antennae not half the length of the body, in male with thicker outer joints, 4th and 5th joints subequal, and longer than 6th and succeeding joints; basal and apical joints reddish brown, remainder dark brown or piceous. Prothorax a little over twice as broad as long, narrowed anteriorly, with narrow lateral margin wider at apical angle, basal margin somewhat sinuate, surface granulose alutaceous; yellow brown with rather indefinite, sometimes diffuse

darker areas. Scutellum small, triangular. Elytra oval with feeble humeral prominences, smooth and moderately convex, surface alutaceous but less granulose than prothorax and finely and rather sparsely punctate; color variable, in one specimen mostly yellow brown with the dark piceous suture wider at the middle and at apex, the humeri and sides piceous, the lateral darkening wider at humerus, at middle, and at apex; second specimen with a large deep reddish brown litura between humerus and suture, extending nearly to the middle of the elytron, and another smaller more indefinite blotch near apex; third specimen with entirely piceous elytra. Body beneath yellowish or reddish brown, lightly pubescent; first tarsal joint of anterior legs in male enlarged; hind femora very large; typical double spur at the end of hind tibiae. Length 3.2 to 3.4 mm.; width 1.8 mm.

Type.—Male and 2 paratypes (female), U. S. N. M. Cat. No. 51840, 3 other paratypes in the Museum of Comparative Zoology, Cambridge, Mass.

Type locality.—Santiago de las Vegas, Cuba, collected by A. Otero 5 Oct. 1932, feeding on *Tabebuia pentaphylla*.

This species of *Megistops*, although variable in its markings, does not agree in any of its color forms with other species described from the West Indies. *M. adulta* Suffrian from Cuba is pale yellow and has antennal joints of slightly different proportions. *M. rubropustulata* Suffrian, from Cuba, differs in having six spots on each elytron, as well as differently proportioned antennal joints. *M. fictor* Weise from Porto Rico, which strongly resembles *rubropustulata*, is also differently marked from *tabebuiae*. In both *M. ornatus* and *pretiosus* Baly from South America the thorax is three times as broad as long, which is not true of this species.

A. Roman has compared specimens of this species with Boheman's *Megistops 4-notata* and *lugubrina* (which he believes are probably color forms of one species) described from "St. Francisco," Calif., and writes that it is different from Boheman's species. In Boheman's species the eyes "coalesce with at most a very fine line indicating the limit." In *Megistops tabebuiae* the eyes although closely placed are quite distinct.

Paratrikona turritella, n. sp.

(Pl. 5, Fig. 10.)

Subtriangular, broadest near the shoulders, convex, pale reddish brown, not very shining, the prothorax with several small callosities on either side, the elytra with a hump before the middle and with a wide explanate margin produced anteriorly at the shoulders; punctation of elytra deep and coarse. Length 10 mm., width 8.5 mm.

Head concealed from above and withdrawn into prothorax, the prosternum from below and explanate margin of the prothorax from above forming a sort of hood about head, this hood broken sharply on either side opposite the eye

by a deep emargination of the prosternum, thereby forming an almost right-angled tooth; head pale yellow brown with darker mouthparts, front declivous. Antennae reddish brown with the four apical joints deep brown, gradually thickened and more pubescent towards apex; 4th and 5th joints subequal and longer than 3rd. Prothorax nearly twice as wide as long, with widely explanate hyaline margin, slightly reflexed on sides, anterior margin curving forward over head, on sides becoming widest at the middle and contracting towards base; basal margin deeply sinuate over scutellum; surface uneven with small irregular callosities on either side and obsolete punctures and rugosities, margin reticulate. Scutellum triangular. Elytra widest near shoulder, convex, with a hump below scutellum before the middle, the tip of which is more produced than in *lerouxi* but is not a real spine as in *turrifera;* margin reticulate and hyaline, widely explanate and produced anteriorly nearly to the widest part of the prothorax; at shoulder and a little before the middle and at small intervals from the middle to the apex occur thickenings running down from disk into the explanate margin; punctures very large and deep, forming near suture three rows, the rest more or less confused. Body beneath yellow brown, shining.

Type.—U. S. N. M. Cat. No. 51837.

Type locality.—Sierra Maestra, Oriente Province, Cuba, alt. 1100–1300 mm., collected in July, 1922, by S. C. Bruner and C. H. Ballou.

Maulik (Proc. Zool. Soc., 1916, p. 582) divided the genus *Batonota*, which was described by Hope (Ann. Nat. Hist., vol. 3, 1839, p. 98) into three genera,—*Batonota*, *Akantaka*, and *Trikona*. In the original genus, *Batonota*, were left the species with a prominently drawn out double spine on the elytra and a trapezoidal scutellum. In *Akantaka* were put the species having a trapezoidal scutellum and a hump, not a spine, on the elytra. In *Trikona* were put the species with a triangular scutellum and with more or less gibbous elytra. Spaeth (Wien. Ent. Zeit., vol. 40, 1923, p. 65) added still another genus, *Paratrikona*, which took from *Trikona* 2 of its 3 species, leaving only *T. humeralis* (Oliv.). Spaeth separated *Paratrikona* from *Trikona* by the following points: In *Trikona* the body is oval, the beetle being broadest near the middle of the elytra; the head is visible from above, the prothorax being emarginate anteriorly; the prosternum is without a prominent tooth; the elytral shoulder angles are narrowed and near the prothorax; and the claws are weakly divergent. In *Paratrikona* the body is triangular, being broadest near or at the shoulders, and the shoulders stand away from the prothorax, the head is not visible from above; the anterior edge of the prosternum is deeply emarginate, thereby producing a sharp corner or tooth; and the claws are not divergent. In this genus Spaeth put *turrifera* Boh. from Haiti and *lerouxi* Boh. from Cuba.

S. C. Bruner and C. H. Ballou have collected in the Sierra

Maestra, Cuba, a species which appears to belong to Spaeth's genus *Paratrikona*. It is most closely related to *P. lerouxi* but has a more developed hump on the elytra which becomes almost a spine as in *turrifera*, yet is not so attenuated as in the latter. The single specimen from which the specimen is described is a little larger than any specimen examined of *lerouxi* and considerably larger than those seen of *turrifera*.

Elytrogona nigrodorsata, n. sp.

(Pl. 5, Fig. 11.)

Reddish brown with pale yellow antennae and with the convex part of the elytra deep bluish black. Elytra strongly convex, shining, and with cribrate punctation. Length 7.8 to 9.5 mm., width 7 to 7.5 mm.

Head barely visible from above, alutaceous with traces of coarse punctation, and with a deep median vertical groove running from the vertex to between the antennal sockets; mouth parts edged with deeper brown. Antennae not extending much below prothorax, the first five joints sparsely, the remainder more densely pubescent, third joint nearly equal in length to basal joint, longer than fourth, fourth longer than fifth, remainder gradually thickening to the apex. Prothorax over twice as wide as long, curving widely from the head to the middle, then with straight sides to the basal angle, very slightly emarginate over head, the explanate margin becoming wider at sides and a little reflexed; basal margin not sinuate, edged with piceous; surface smooth, dull and alutaceous, with a light median line. Scutellum tiny, reddish, triangular, very shining. Elytra semi-globose, at base not wider than the prothorax, with an explanate margin curving from base outwards and forming a small angle before the middle, thence narrow to the apex, in one specimen (? female) the explanate margin from the angle nearly to the apex not visible from above; surface very shiny with cribrate punctation and with gross deep punctures along the explanate margin. Body beneath shining, no trace of underwings visible.

Type.—M. C. Z. No. 22369 and 1 paratype in Museum of Comparative Zoology, Cambridge, Mass., 1 paratype U. S. N. M. Cat. No. 51847.

Type locality.—Mt. Basil, northern Haiti, 4700 ft., collected 9 Sept. 1934, by P. J. Darlington.

Of the few species already described in this genus, *Elytrogona nigrodorsata* is most distinctive in its coloration. All the other species have either entirely red elytra or red elytra spotted with black. This species except for the reddish explanate margin has deep blue black elytra. It is similar to all of the others in the reddish brown coloration of the rest of the body and in the angulate margin and coarsely cribrate elytra.

CERADRYOPS PUNCTATUS, NEW GENUS AND SPECIES OF DRYOPIDAE FROM CEYLON (COL.).

By Howard E. Hinton,
Zoological Laboratory, Cambridge.

Through the kindness of Dr. H. Scott I have been able to borrow from the collection of the British Museum (Natural History) a remarkable species of dryopid belonging to a new genus which I place in the subfamily Dryopinae, where it seems to fit best. The genitalia (female), as nearly as I can make out from the basal portion alone, appear to belong to the non-stylet-bearing type common to the Dryopinae. The single specimen, a female, is in rather a bad state, one elytron and the apex of the genitalia having been lost.

CERADRYOPS, gen. n.

(Figs. 1, 2).

Subparallel, moderately convex. *Head* partially retractile; eyes broadly separated, moderately densely clothed with short, erect hairs; antennae 3-seg-

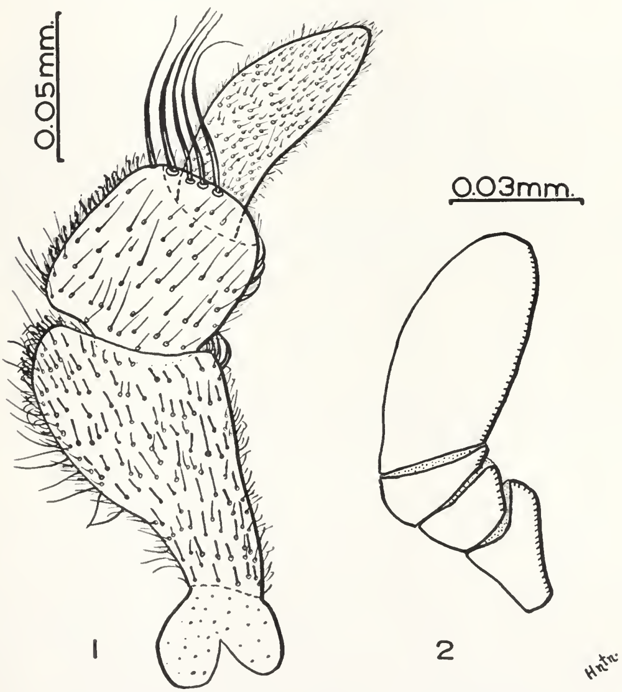


Fig. 1. Antenna of *Ceradryops punctatus* Hinton.
Fig. 2. Maxillary palpus of the same.

mented (fig. 1), broadly separated at base; mandibles with three acute, apical teeth, with a well-developed and entirely membranous prostheca; maxillary palpi 4-segmented (fig. 2). *Pronotum* on each side with a well-developed sublateral sulcus extending from base to very nearly apex; without distinct median longitudinal or transverse impressions. *Elytra* with the epipleura broad and distinct to apex; surface of elytra not striate, densely punctate without any arrangement of the punctures in rows. Scutellum small, triangular. *Prosternal process* as long as prosternum at middle, moderately narrow, parallel between coxae and acute at apex, prosternum anteriorly distinctly lobed. Metasternum with a feeble, median longitudinal, impressed line. Legs moderately long; inner sides of apices of tibiae without a fringe of tomentum; claws long and as strongly developed as usual in this family. *Female genitalia* with the apex lost but base appearing to belong to the non-stylet-bearing type.

Genotype: **Ceradryops punctatus,** sp. n.

Ceradryops Hntn. differs strikingly from all other genera of the family in the great reduction of the number of antennal segments to three. This genus does not appear to be closely related to any of the genera of Dryopinae so far described.

Ceradryops punctatus, sp. n.

(Figs. 1, 2.)

Female: Length, 1.95 mm.; breadth, 1.05 mm. Subparallel, moderately convex. Eyes clothed with short, fine, erect, moderately dense hairs; dorsal surface elsewhere (except margins of prothorax and elytra) with extremely fine and short (scarcely visible under a magnification of X144) hairs arising from the punctures; margins of prothorax and elytra with a row of much longer, suberect hairs; ventral surface clothed moderately densely with fine, recumbent to nearly erect, testaceous hairs which are generally about half again as long as hairs on eyes. Cuticle feebly shining, legs more strongly shining; moderately dark rufo-piceous; head behind clypeus, prothorax, elytra and upper surface of apices of femora and bases of tibiae black. *Head* without distinct impressions; inner margins next to eyes feebly and narrowly raised; labrum with the anterior margin feebly and evenly arcuate. Surface with generally round punctures which are nearly as coarse as facets of eyes (.012 mm.) and are seldom separated by more than their diameters; labrum with the punctures finer and less distinct. *Prothorax* at greatest breadth which is at basal two-fifths more than one-third broader than long (.71 mm. : .42 mm.) and base broader than apex (.58 mm. : .50 mm.). Apical margin as seen from above feebly arcuately, nearly truncately, feebly emarginate; apical angles moderately prominent, broadly rounded; sides moderately strongly arcuate, converging feebly toward apex, lateral margins nearly smooth; basal angles inconspicuous, broadly rounded; base bisinuate, broadly and moderately feebly sinuate on each side and rounded in front of scutellum. Pronotum moderately feebly convex; sublateral sulcus ending abruptly slightly beyond apical one-seventh; on basal one-third adjacent to and inner to sublateral sulcus with an indefinitely bounded, moderately shallow, broad, longitudinal impression; slightly before apical fourth with an

extremely feebly indicated, moderately broad, transverse impression extending to sublateral sulcus and here becoming more distinct. Surface punctate throughout similarly to head. *Elytra* three times as long as prothorax (1.32 mm. : 42 mm.) and from humeri moderately broadened to broadest point at apical third. Humeri feebly gibbous. Lateral margins nearly smooth. Surface with the punctures usually round, about half again as coarse as those of prothorax and seldom separated by as much as their own diameters. Scutellum triangular with the angles rounded, longer than broad (.07 mm. : 0.6 mm.), flat; surface sculptured as pronotum. *Prosternum* with apical half moderately strongly lobed; process as long as prosternum at middle, parallel between coxae, acute at apex, sides opposite coxae strongly and moderately broadly elevated, from apex to nearly opposite posterior portion of coxae with a strong, carina-like, median longitudinal elevation; on each side continuing from elevated sides opposite coxae is an extremely fine line of close granules extending nearly to lobed portion; surface near middle with a few extremely fine, round granules, surface of prosternum generally and that of hypopleura indistinctly, finely punctate. Disk of metasternum with a very feebly impressed median line extending from base to apex; surface punctate as prosternum but with an occasional coarser puncture; sides similarly punctate but with the coarser punctures more numerous though very indistinct. Basal abdominal segment with a fine carina extending at middle from base to apex, the basal portion of the carina being rather indistinct due to numerous rugae; elsewhere the abdominal segments are sculptured as metasternal disk. Legs, especially tibiae and tarsi, rather sparsely pubescent and punctate only with extremely fine, microscopical punctures; fifth tarsal segment longer than the combined length of the first four; claws about half as long as fifth tarsal segment.

Male.—Unknown.

Type.—A female in the collection of the British Museum (Natural History). Ceylon: Mandulsima, VIII–1908 (*T. B. Fletcher*).

DESCRIPTIONS OF SIX NEW SPECIES OF BLISSUS (HEMIPTERA-HETEROPTERA : LYGAEIDAE).

By H. G. Barber,
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All of the species herein described were collected on various kinds of wild grasses and probably will prove to be of no economic interest. Of the six forms previously known, *Blissus occiduus* Barb., from the Rocky Mountain States, and *B. arenarius* Barb., from the Atlantic coast, are exclusively grass feeders. *B. hirtus* Mont., ranging all over the northeastern section of the United States as far south as Pennsylvania and

west at least to Minnesota, is also primarily a grass feeder. This is the form, erroneously reported as *B. leucopterus* Say, which has been the cause of so much damage to lawns and golf greens in New England. It seems very probable from the evidence at hand that this species becomes a serious pest to grains only in exceptional seasons. *B. insularis* Barb, occurring in the West Indies and Florida and described as a variety of *B. leucopterus*, is by preference a grass feeder, so far as known. As *B. leucopterus*, the destructive grain pest, is to be considered in a later paper, it is omitted from consideration at present, as is also *B. validus* Blatch., described from Indiana.

Blissus omani, new species.

Brachypterous form: Black; head, pronotum, and scutellum grayish pruinose, rather sparsely grayish pilose; abbreviated corium tawny, membrane white; legs, rostrum, and antennae testaceous, terminal segment, except at extreme base, piceous.

Narrow, elongate, parallel sided posteriorly. Head about one-fifth wider than long; antenna relatively short, lengths of the segments as follows: I, 0.14; II, 0.30; III, 0.26; IV, 0.50 mm. Rostrum extending to middle of intermediate coxa; lengths of the segments as follows: I, 0.20; II, 0.20; III, 0.16; IV, 0.20 mm. Pronotum nearly one-fifth wider than long (0.76 by 0.56 mm.), widest just before the middle region, thence rather strongly rounded anteriorly; disk before the middle finely punctate, posterior third impunctate. Scutellum two-fifths wider than long, with a few scattered, fine, discal punctures. Abbreviated hemielytra about twice as long as scutellum, extending very slightly beyond posterior outer angle of metapleura, usually the two coria slightly in contact behind apex of scutellum; membrane about one-third as long as corium, its apical margin obtusely rounded. Abdomen parallel sided, 0.80 mm. wide, elongate, region behind pronotum just over twice as long as head and pronotum combined; tergum and venter densely grayish tomentose. Length 3.20 mm.

Type, male.—Huachuca Mts., Ariz., June 11, 1933 (P. W. Oman). *Paratypes*, 8 males and 5 females with same data as type. U. S. N. M. Cat. No. 52021.

All of the specimens before me are brachypterous. It is much more slender than *B. leucopterus*, the pronotum is widest before the middle, and the antennae are distinctly shorter.

Blissus nanus, new species.

Brachypterous form: Black; head, except apex of tylus, anterior three-fourth of pronotum, and basal half of scutellum, grayish pruinose, sparsely covered with mostly recumbent silvery white hairs, scarcely long pilose; posterior one-fourth of pronotum velvety black; corium sordid white, more or less marked with fuscous apically, membrane white, apex of tylus, legs, rostrum, and antenna testaceous, terminal segment of the latter piceous.

Narrow, elongate, parallel sided. Head about one-fourth wider than long;

antenna relatively short, lengths of the segments as follows: I, 0.12; II, 0.20; III, 0.18; IV, 0.40 mm. Rostrum extending to base of intermediate coxa, lengths of the segments as follows: I, 0.22; II, 0.24; III, 0.14; IV, 0.18 mm. Pronotum distinctly wider than long (0.68 by 0.48 mm.), widest across the middle region, thence very gently rounded to anterior margin, parallel sided behind middle. Scutellum two-fifths wider than long (0.40 by 0.24 mm.), only the depressed basal part sparsely punctate. Abbreviated hemielytra nearly or quite twice as long as scutellum, extending to outer angle of metasternum, not in contact behind apex of scutellum; membrane one-fourth length of corium, its posterior margin broadly rounded. Abdomen parallel sided, 0.72 mm. wide; region behind pronotum two and one-half times as long as head and pronotum combined. Length 2.80 mm.

Type, male.—Garnett, Kans, July 1, 1936 (P. W. Oman). *Paratypes:* 10 males and 4 females with same data as type; 4 males, Wellington, Kans., Webster No. 4097. U. S. N. M. Cat. No. 52022.

This species, like the preceding, has been found only in the brachypterous form and is related to *B. omani.* Besides being smaller, it differs from *omani* in the shape of the pronotum, in the shorter antennae, and in the distinctive black coloration of the posterior part of the pronotum.

Blissus planarius, new species.

Macropterous form: Black; head except tylus, pronotum except posterior half, and scutellum grayish pruinose; corium white with apex infuscated; membrane hyaline; apex of tylus, anterior margin of pronotum narrowly, and posterior margin more broadly testaceous; legs, rostrum, and antennae testaceous, the apex of second and all of third and fourth segments of the latter infuscated.

Narrow, elongate; head, anterior half of pronotum, and scutellum with grayish white incumbent and erect hairs. Head about one-fifth wider than long; tylus shining black; antenna with lengths of segments as follows: I, 0.16; II, 0.32; III, 0.26; IV, 0.50 mm. Rostrum relatively long, apex reaching to posterior coxae or extending slightly beyond these; lengths of the segments as follows: I, 0.36; II, 0.50; III, 0.30; IV, 0.30 mm. Pronotum nearly one-third wider than long (1.00 by 0.68 mm.); anterior pruinose area finely punctate; posterior piceous part nearly denuded and more sparsely punctate, sides not parallel, widest across humeral angles, the two margins distinctly converging anteriorly, more abruptly converging at anterior fourth. Scutellum one-fourth wider than long (0.48 by 0.36 mm.), with fine scattered punctures over the disk and a submarginal row of coarse punctures. Abdomen nearly parallel sided, 0.92 mm. wide; region behind pronotum about twice as long as head and pronotum combined. Length 3.28 mm.

Brachypterous form: Posterior two-thirds of pronotum parallel sided; hemielytra about three times as long as scutellum, extending well behind posterior outer angle of metapleura, both clavus and inner margins of membrane in

contact behind apex of scutellum; membrane a little less than half as long as corium, broadly rounded at apex.

Type, male.—Laramie, Wyo., July 20, 1935 (P. W. Oman). *Paratypes:* 6 males (5 brachypterous) and 6 females (2 brachypterous) with same data as type; male (brachypterous), Ft. Collins, Colo. (C. F. Baker). U. S. N. M. Cat. No. 52023. Lyman, Wyo., June 25, 1935 (Jack Beamer), Coll. University of Kansas.

This is another elongate, narrow form, but, unlike the three aforementioned species, it occurs in both the long and short winged forms. As compared to *leucopterus*, it is narrower, more pruinose, and with a longer rostrum.

Blissus villosus, new species.

Brachypterous form: Head except tylus, pronotum in great part, and scutellum piceous; tylus and narrow anterior and posterior submargins of pronotum fuliginous, the anterior region of the latter slightly pruinose; corium yellow-white to tawny, lightly embrowned apically; membrane white, sometimes lightly tinted with brown; abdomen castaneous; legs, rostrum, and antenna testaceous, terminal segment of the latter more or less infuscated.

Elongate oval, rather densely long pilose, more shaggy than the three preceding species. Head one-fifth wider than long, with scattered, mostly erect, whitish hairs. Antenna rather densely pilose, the lengths of the segments as follows: I, 0.14; II, 0.32; III, 0.30; IV, 0.48 mm. Rostrum extending to apices of intermediate coxae, lengths of the segments as follows: I, 0.30; II, 0.34; III, 0.22; IV, 0.22 mm. Pronotum about one-third wider than long (0.88 by 0.64 mm.), rather densely long pilose, somewhat shaggy, posterior two-thirds parallel sided; posterior margin nearly truncate, the large plumbeous areas on either side of middle finely punctate. Scutellum much wider than long (0.48 by 0.28 mm.), with a few fine scattered punctures and a few fine erect hairs. Abbreviated hemielytra almost or quite twice as long as scutellum, not in contact behind apex of scutellum, membrane very short, very broadly rounded at apex, confined to outer two-thirds of posterior margin of corium. Abdomen with outer margins very gently rounded from base to near apex, 1 mm. wide; region behind pronotum about twice as long as head and thorax combined. Length 3.20 mm.

Type, male.—Mint Canyon, Calif. (near Saugus), June 7, 1935 (P. W. Oman). *Paratypes:* 35 males and 24 females with same data as type. U. S. N. M. Cat. No. 52024.

All of the specimens before me are brachypterous. This species is much more villose than any of the others herein described and the margins of the abdomen are not parallel. Compared to *leucopterus* it is more shaggy, relatively more elongate, and has shorter antennae.

Blissus mixtus, new species.

Brachypterous form: Piceous, pronotum with anterior margin more narrowly and posterior margin more broadly brownish testaceous, anterior disk on either side of middle plumbeous; anterior submargin and posterior one-third dark brown; corium sordid white, apical angle and some of the veins apically fuscous. Membrane lacteous. Tergum castaneous. Apex of tylus, rostrum, legs, and antenna testaceous, third and fourth and frequently apex of second segment of the latter infuscated.

Ovate. Head about one-fifth wider than long (0.56 by 0.40 mm.). Antenna with lengths of segments as follows: I, 0.16; II, 0.30; III, 0.26; IV, 0.50 mm. Rostrum reaching to apex of intermediate coxa; lengths of segments as follows: I, 0.32; II, 0.40; III, 0.24; IV, 0.24 mm. Pronotum nearly one-third wider than long (0.92 by 0.64 mm.), sparsely covered with grayish white hairs, those along the margins longer; plumbeous area of anterior disk finely punctate, posterior third nearly nude; lateral margins straight and parallel posteriorly, anterior one-fourth strongly rounded to anterior margin; posterior margin nearly straight. Scutellum much wider than long (0.44 by 0.28 mm.), with a few fine discal punctures on either side of middle. Abbreviated hemielytra extending posteriorly to about middle of tergum, not quite four times as long as scutellum, hairs of costal margin similar to those of pronotum, the two clavi as well as inner margins of membranes in contact behind scutellum; membrane a little less than one-half the size of corium, bluntly rounded posteriorly. Abdomen 1 mm. wide, outer margins gently rounded; region behind pronotum subequal to head and pronotum combined. Length 3.12 mm.

Type, male.—Alameda County, Calif., July. *Paratypes:* 22 males and 8 females with same data as type; 1 male and 4 females, San Francisco, Calif., March 30, 1912 (J. C. Bridwell); male and female, Salton, Calif., March 28 (H. G. Hubbard); male, Monterey, Calif. (E. A. Schwarz), U. S. N. M. Cat. No. 52025. Female, Sunset Beach, Calif., July 30, 1935 (R. H. Beamer), University of Kansas.

All of the specimens so far seen are brachypterous. It is related to *leucopterus* but the shape of the pronotum is quite different. Besides being differently shaped, it is very much less punctate, with fuscous maculations of the corium fainter, etc.

Blissus breviusculus, new species.

Black; pronotum and scutellum pruinose, abbreviated hemielytra sordid yellow, with apical margin before membrane narrowly and obscurely infuscated; rostrum, legs, and antenna testaceous, the latter with apical part of third and all of terminal segment infuscated. Head, antennae, pronotum, margins of hemielytra, and abdomen densely grayish pilose.

Head one-third wider than long (0.36 by 0.48 mm.), except for the tylus covered with dense matted pubescence; apex of tylus testaceous. Antenna short and robust; lengths of segments as follows: I, 0.12; II, 0.24; III, 0.20;

IV, 0.40 mm., terminal segment nearly four times as long as its diameter. Rostrum reaching to posterior coxa, lengths of segments as follows: I, 0.24; II, 0.32; III, 0.28, IV, 0.24 mm. Pronotum finely punctate and densely covered with pale pubescence; almost one-third wider than long (0.52 by 0.76 mm.); greatest diameter across middle area; posterior margin lightly, concavely arcuate. Scutellum over twice as wide as long (0.36 by 0.16 mm.); a few coarse punctures along lateral margins. Abbreviated hemielytra 0.40 mm. long, of which the membrane occupies 0.12 mm.; as seen from the side, not extending beyond middle point of first visible abdominal segment; very slightly contiguous at apex of scutellum; outer apical margin of membrane bluntly, symmetrically rounded, nearly straight inwardly. Abdomen 1.68 mm. long (dorsal view), a little longer than head and pronotum taken together; lateral margins gently rounded in dorsal outline, 0.92 mm. wide across middle point. Propleurum and venter along sides rather densely pilose, the latter very sparsely pilose on central disk. Legs testaceous, stout, sparsely long pilose. Length 2.40 mm.

Type, male.—Wareham, Mass (C. A. Frost). *Paratypes:* 3 males, same data as type. U. S. N. M. Cat. No. 52026. One female, Harbor, Maine, IV, 20, 1915 (S. L. Mason), in the collection of H. M. Parshley. The four Massachusetts specimens were collected by C. A. Frost under stones, and sent with other miscellaneous material to Walther Horn of the Deutsches Entomologisches Institut, who in turn sent them to me for determination. Doctor Horn has generously allowed the type and one paratype to be deposited in the U. S. National Museum.

This little species, found as yet only in the brachypterous form, is rather closely related to the western *Blissus occiduus* Barb. (1918, Bul. Brooklyn Ent. Soc. XIII : 36). In *B. breviusculus* the head, pronotum, and scutellum are relatively broader in relation to their length and more pilose, and the antenna longer, particularly the terminal segment, which is nearly twice as long as the third. Although it has considerable resemblance to depauperate examples of *Blissus leucopterus*, it can not, in my opinion, be that, as the relative proportions of the pronotum and scutellum, as well as the relative length of the antennal segments, would preclude this.

A NEW SPECIES OF TRIATOMA FROM ARIZONA (HEMIPTERA-HETEROPTERA : REDUVIIDAE).

By H. G. Barber,

United States Department of Agriculture,
Bureau of Entomology and Plant Quarantine.

Triatoma longipes, new species.

Piceous; outer margin of connexivum narrowly ochraceous-red. Head long and rather narrow, slightly longer than pronotum, just over twice as long to collum as width across eyes; eyes well projected, seen from above each only

about one-fourth less in width than space between them; preocular lateral margin to apex of antenniferous tubercle distinctly shorter than the margin before the tubercle but a little longer than an eye; postocular lateral margins only very slightly converging to collum; ocelli large, distinctly elevated. Antenna rather long, basal segment not quite reaching apex of head, second segment nearly twice as long as basal, densely covered with fine inclined hairs, third segment one-fifth shorter than second, terminal segment a little shorter than third. Rostrum slender, extending at least to middle of prosternum, nearly nude except for a few fine hairs on terminal segment, second segment not quite twice as long as basal. Pronotum one-third wider than long, nude, somewhat shining; transverse impression placed well before the middle, anterior lobe about one-half as long as posterior, the former, anteriorly, with a small discal tubercle on either side of the median, longitudinal impression, lateral margin roughened; outer anterior angle slightly produced in a conical tubercle; posterior lobe distinctly rugose, anteriorly, with two distinctly elevated, slightly divergent longitudinal carinae which disappear near the middle of the disk; lateral margin slightly impressed, a distinct rounded nodule within each humeral angle. Scutellum with a long, slender, nearly cylindrical, apical process. Connexivum strongly expanded beyond costal margins of corium. Legs long and slender. Length 28 mm.

Type, male: Roosevelt Post Office, Ariz., Tempe No. 6604, May 28, 1927 (M. C. Telford. Paratypes, males: 7 Tucson, Ariz., May, 1931; 1, same locality, Sept. 15, 1931 (Mrs. M. H. Koogler); 2, Huachuca Mts., Ariz., 1905 (C. Schaeffer); 3, Prescott, Ariz., June 14, 1936 (T. P. Morgan); 1, Octave, Ariz., July 23, 1923 (E. M. Barnett); female: 3, Tucson, Ariz., May, 1931 (Mrs. H. K. Koogler); 1, Reddington, Ariz. (Dr. W. Barnes); 1 nymph, Tucson, Ariz., May 17, 1930 (Mrs. M. H. Koogler). U. S. N. M. Cat. No. 52039.

This species is fully as large as *gerstaeckeri* Stål and more closely related to that than to any other described species. It differs from *gerstaeckeri* in having the head more produced before the eyes, which are also less protruding, the lateral postocular margins more nearly parallel, lateral margin of anterior lobe of pronotum devoid of a tubercle, the legs relatively longer and the connexivum not alternated with ochraceous red and black.

MINUTES OF THE 481ST REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

The 481st regular meeting of the Society was held at 8 P. M., Thursday, March 4, 1937, in Room 43 of the Natural History Building of the National Museum. Thirty members and four visitors were present, with N. E. McIndoo presiding. The minutes of the previous meeting were read and approved.

A. B. Gurney presented the name of Arthur R. Buddington, College Park, Md., who, upon recommendation of the Executive Committee, was unanimously elected to membership.

Mr. Gurney read the obituary notice, which he and H. G. Barber had drawn up concerning Lawrence Bruner, and stated that they had also prepared a biographical sketch. The Society voted to accept these for publication in the Proceedings.

The chair made a brief report on the Executive Committee meeting held February 3, mentioning the authorization of expenditures by the Corresponding Secretary for clerical help and for wrapping paper and twine for back numbers of the Proceedings. The chair also stated that the Executive Committee had approved the changes in rules governing illustrations and gratis copies of the Proceedings (notice of which appears in the February number), and had discussed arrangements for the June meeting.

The Society voted to hold the June meeting at the Beltsville Laboratory.

Under the heading of "Notes and Exhibition of Specimens," E. A. Back showed specimens of *Halobates sericeus* Eschs. from Waikiki, and stated that this species had been blown on the beach from the ocean in immense numbers. Dr. Back also mentioned having observed honeydew from *Pseudococcus nipae* Mask. which had crystallized on the foliage.

Mr. R. E. Snodgrass called attention to a recent paper by Dr. G. C. Crampton (1936 Bull. Brooklyn Ent. Soc., 31 : 141–149), in which Dr. Crampton points out that the looping of the ejaculatory duct over the top of the rectum and down on the right to its outlet in cyclorrhaphous Diptera can mean only that the ninth abdominal segment of the male has made a complete revolution to the right, while it appears that the seventh and eighth segments have made a half turn in the same direction. Mr. Snodgrass said that from his own studies he found that the dorsal muscles of these segments, though weakly developed, follow a straight course along the back from the fifth to the last segment. (Author's abstract.)

Mr. C. T. Greene spoke briefly on a remarkably fine collection of fruit flies collected in 1935 and 1936, in East Africa, by Messrs. F. A. Bianchi and N. L. H. Krauss of the Bureau of Entomology and Plant Quarantine. This collection added a number of species to the Museum collection and several undescribed species. There was also added a fine lot of fruit flies collected in West Africa by R. H. Van Zwaluwenburg. This material also added several species new to the above collection and several undescribed ones. These two collections contained species mostly in the genera *Ceratitis* and *Dacus*. The two lots greatly enriched the collection for future study. (Author's abstract.)

Mr. C. F. W. Muesebeck stated that specimens of a new species of *Mirax*, reared from the coffee leaf miner on Guadeloupe, had been received from Mr.

Francisco Sein, Jr., of the Agricultural Experiment Station of the University of Puerto Rico. Mr. Muesebeck added that although very few specimens are known for any recognized species of this genus, eighty-five were submitted in this case, and that plans are under way for the introduction of the species into Puerto Rico for control of the coffee leaf miner.

Mr. E. R. Sasscer conveyed greetings of some time past from the Hawaiian Entomological Society, and told of the fine banquet given by that society which he had attended.

The first paper on the regular program was given by Dr. C. E. Burnside, and entitled "Controlling Honeybee Diseases."

In modern beekeeping where a hundred or more colonies of bees are often kept in a single apiary, infectious bee diseases are capable of spreading much more rapidly than among bees in the wild state or in small widely separated apiaries. American foulbrood is the most destructive of all the bee diseases since it practically always kills the colonies. The shaking treatment for American foulbrood (transferring the bees to clean hives) is unreliable. None of the methods of disinfecting the diseased brood combs that have been tried is reliable. Burning the diseased bees and combs is the most dependable treatment for this disease. On rare occasions colonies with American foulbrood recover and occasionally a colony that is exposed to infection does not contract disease. The Federal Bee Culture Laboratory, in cooperation with the State Experiment Stations of Iowa, Texas, Wisconsin, and Wyoming are attempting to find and propagate a strain of bees with a high degree of resistance to American foulbrood. Several colonies now under observation appear to have recovered from American foulbrood following inoculation with lethal doses.

Experimental work with heat for destroying *Bacillus larvae* spores indicates that this bacterium will withstand boiling water for several hours and autoclaving at 15 lbs. pressure for at least 30 minutes. Its resistance to live steam and dry heat is correspondingly great.

European foulbrood of bees is less destructive than American foulbrood. It is thought to be of bacterial origin but its etiology is incompletely understood. Common black bees are susceptible; Italian bees are less so. Restocking with Italian bees and good beekeeping practice help to control this disease. It is reported that, in the Pacific Coast States, Italian bees are often seriously affected by European foulbrood. Preliminary experiments at Beltsville, Md., indicate that the Caucasian bees used are resistant to European foulbrood and the Carniolan bees used seem to be more resistant than are common black bees.

Parafoulbrood resembles European foulbrood and seems to respond to the same treatment. It is a destructive disease but is restricted in its distribution.

Sacbrood is a prevalent disease but as a rule causes only slight losses. It is caused by a filterable virus. Colonies usually recover without treatment.

Nosema disease often causes extensive losses of adult bees. It is caused by the protozoan parasite *Nosema apis* and spreads within the hive and through contaminated watering places. Spread of this disease can be checked to some extent by providing clean water for the bees and by removing contaminated watering places.

Acarine disease causes extensive losses in Europe but does not occur in this country. Importation of bees is restricted by an Act of Congress and all importations are examined at the Federal Bee Culture Laboratory to determine their freedom from the parasitic mite *Acarapis woodi* (Rennie). (Author's abstract.)

Questions were asked Dr. Burnside by Dr. Fracker, Mr. Muesebeck and Mr. Oman.

The second paper on the regular program, by E. C. Cushing and D. G. Hall, entitled "Some Morphological Differences between the Screwworm Fly and Closely Related or Similar Species in North America (Diptera : Calliphoridae)," was given by Mr. Cushing. Since this paper is to be published in the Proceedings at a later date, no abstract is presented here.

Adjournment followed at 10 P. M.

CATHERINE FORD,
Recording Secretary.

BOOK NOTICE.

CULTURE METHODS FOR INVERTEBRATE ANIMALS; A Compendium Prepared Cooperatively by American Zoologists under the direction of a Committee from Section F of the American Society for the Advancement of Science. Paul S. Galtsoff, Frank E. Lutz, Paul S. Welch; James G. Needham, Chairman, assisted by many specialists whose names appear in connection with their contributions to this volume. 8 vo, cloth, 590 pp., 81 figs., Ithaca, New York, C. Comstock Publishing Company Inc., 1936, $4.00.

This notable volume, prepared under a grant from the National Research Council, contains a hoard of authentic information on the culture of invertebrates, for the working zoologist and student, which has not hitherto been available in print. The treatise opens with a chapter of 50 pages on General Methods of Collecting, Maintaining and Rearing Marine Invertebrates in the Laboratory. This is followed by similar information on the various invertebrates arranged by Phyla and ordinally thereunder, according to the systems proposed in Pratt's Manual of the Vertebrates (1935) and Comstock's Manual for the Study of Insects (1926).

Beginning with the Protozoa, the discussions consist in concise articles presenting specific information on culture media, methods of feeding, handling, and in many cases collection of the individual vertebrates or related groups thereof. Some 260 pages are devoted to the class Insecta, beginning with the Thysanura and ending with the Hymenoptera.

Bibliographic references are placed at the ends of the respective articles and the latter are conveniently cross-referenced. Altogether a most valuable and welcome addition to the literature of the Invertebrates. A well printed substantial volume bound in buff buckram. —W. R. WALTON.

Actual date of publication, April 27, 1937.

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OF THE

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OF WASHINGTON

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Annual dues for members are $3.00; initiation fee $1.00. Members are entitled to the Proceedings and any manuscript submitted by them is given precedence over any submitted by non-members.

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PROCEEDINGS OF THE

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THE BIOLOGY OF SARCOPHAGA CISTUDINIS ALDRICH (DIPTERA), A SPECIES OF SARCOPHAGIDAE PARASITIC ON TURTLES AND TORTOISES.

By E. F. Knipling,[1]

Assistant Entomologist, Division of Insects Affecting Man and Animals, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

The Sarcophagidae as a group present a diversified life history. Many of the species breed as scavengers in decaying meats, animal excrements, or dead insects, whereas the larvae of others are parasitic on various insects and other animals. Among the parasitic forms is *Sarcophaga cistudinis* Aldrich, which is a true parasite on various species of turtles and tortoises. This is the only sarcophagid in this country known to exist as a larval parasite on reptiles.

Sarcophaga cistudinis was described by Aldrich (*1*) in 1916, from specimens bred from a box turtle in New Jersey. The species was recorded in turtles as early as 1882, by Packard (*6*). Other references apparently to this species are those of Wheeler (*8*), Emerton (*3*), and Kepner (*5*).

The writer has examined larvae collected from the gopher tortoise (*Gopherus polyphemus*) from Florida, Georgia, and Mississippi, from a box turtle (*Terrapene* sp.) from Florida, and from an elephant tortoise (*Testudo* sp.) in a zoological park in Houston, Tex. According to the collector this tortoise was imported from the Galapagos Islands several years before it became infested. *Sarcophaga cistudinis* apparently is well distributed, at least in the eastern and southern parts of the United States. It has a wide host range among the land turtles, and Chidester (*2*) reports an infestation in the terrapin (*Chrysemys picta*).

Little has been published concerning the biology of this species. Greene (*4*) described the puparium and briefly described the third-instar larva.

This paper presents data on the life history of the species in *Gopherus polyphemus* and a description of the immature larval stages.

[1] The writer is indebted to A. L. Brody and B. V. Travis, of the Bureau of Entomology and Plant Quarantine, for assistance in this study, and to H. B. Bradford for making the drawings.

LIFE HISTORY AND HABITS.

Gopher tortoises were obtained from burrows in the vicinity of Valdosta, Ga., during January, 1936. Three of the seven tortoises collected were infested. Infestations in each case were on the posterior exposed portion of the host, on the femur near the anus, and in one tortoise, which was dead, on the hind femur and a portion of the tibia. In the dead tortoise there were 200 larvae, and one leg had been nearly destroyed.

According to D. G. Hall[2] infestations are also commonly found on the neck and front legs of turtles. Such infestations occur in the folds of skin on the legs and on the thinner skin of the neck. An infestation in a box turtle, collected by B. V. Travis, was located at the hinge of the plastron, between the plastron and the carapace.

Two living tortoises, collected on January 11, were placed in a heated room at a temperature ranging from 65° to 80° F. The larvae, already well advanced in the third instar, matured and migrated from the hosts 22 to 36 days later. From one tortoise, 28 larvae were obtained and from the other, 40 larvae.

Specimens of third-instar larvae from gopher tortoises were obtained from central Florida during February and March.

On the basis of these observations this species apparently overwinters as larvae in the host. Hall has made similar observations at Savannah, Ga.

Adults reared from the infested tortoises were fed on a diet of lump sugar, honey, bananas, and water. The flies were confined in a screen cage approximately 1½ feet long, 1 foot wide, and 1 foot high.

Mating was obtained most successfully by placing about 10 males and 5 females in a wide-mouthed pint bottle. The flies also mated when placed on an old wound on a tortoise. Mating required from 15 to 45 minutes.

As with other species of Sarcophagidae, *S. cistudinis* is ovoviviparous. The prelarviposition period of three females, at a mean temperature of about 76° F., was found to be 8, 9, and 10 days, respectively.

Larviposition and Probable Modes of Entrance of the Larvae into the Host.

Gravid females when placed on a tortoise seek favorable places for larviposition. Where an infestation was already present, the fly chose the infested wound. Upon finding a suitable location flies immediately begin depositing larvae. The larvae are deposited in groups of about 10 to 20, several issuing from the larvipositor at the same time.

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[2] Unpublished notes.

It is probable that infestations begin at some abrasion or weakness in the skin of the tortoise. Eight attempts on four tortoises to determine if the larvae could penetrate the normal skin failed in all but one instance. In this case larvae were placed in a fold at the base of the tail of a mature tortoise, and here 3 or 4 out of approximately 20 larvae became established and developed to maturity. In all other attempts, some of which were made on young tortoises, larvae tried to enter between the scales but were unsuccessful in starting an infestation.

The tick *Amblyomma tuberculatum* Marx may serve as one predisposing factor in larval infestations. These ticks are common on gopher tortoises in the vicinity of Valdosta. They may be found attached on any exposed portion of the body but most often on the inside of the hind legs. Scar-tissue formation is apparent at the point of attachment for several months after the ticks have become detached.

A gravid fly, placed on the inside of the hind leg of a tortoise, deposited approximately 40 larvae among 4 adult ticks attached in this region. Some of these larvae succeeded in starting an infestation. On another tortoise three accidental infestations occurred on the inside of one leg. One infestation was beside an attached tick, and old tick scars were present at the point of entrance of the larvae in the other two locations. In a third instance 14 larvae were placed on the inside of one hind leg at a point from which ticks had been pulled off. A large scar caused by ticks was present in the same region. The larvae were closely observed with a hand lens. Most, if not all, of the larvae succeeded in making an entrance in this region, some in the opening caused by the mouth parts of the ticks, but most of them along the edges of the large tick scar.

A large number of larvae are produced by *Sarcophaga cistudinis*. From one gravid female 121 larvae were dissected. Another female deposited approximately 140 larvae. Four other females deposited well over 100 larvae each.

Development of the Larvae and Pupae.

While feeding, larvae congregate in closely packed groups, with the posterior end toward the opening of the wound. Infested wounds resemble those caused by the primary screwworm (*Cochliomyia americana* C. P.) in warm-blooded animals, although the openings of the wounds in tortoises are smaller in proportion to the number of larvae. Infested wounds produce a dark discharge which has an obnoxious odor, although less strong than that caused by *C. americana* larvae in warm-blooded animals.

Dissections of infested wounds show considerable destruction of tissues, and around the infested regions there seems to develop

a cyst-wall formation. The cyst-wall formation in infested wounds has been noted by Hall, who states that such cysts, although apparently healed, persist for several years and may serve as a site for reinfestations year after year.

At a mean room temperature of about 78° F. the first-instar larvae molt in 7 to 11 days, according to observations in four wounds. The duration of the second stage was found to be from 7 to 9 days. The combined developmental period of the first two instars was 14 to 15 days in one tortoise and 17 and 18 days, respectively, in two other individuals. The duration of the third-instar larvae was 28 days in one tortoise and 35 days in another. The total developmental period of all the larval instars was 52 days in one tortoise and 43 in another.

Mature larvae pupate in 18 to 36 hours at a room temperature ranging from 70° to 84° F., or a mean of 78° F. The duration of the pupal stage was found to be 17 to 18 days at the same mean temperature.

The complete developmental period, which includes the prelarviposition period and the larval and pupal stages, under the conditions mentioned, was 69 days in one tortoise and 81 in another. This is considerably longer than in most other species of Sarcophagidae whose life history is known. The developmental period no doubt would be shorter at higher temperatures, as found in midsummer, and longer during the winter months. However, the temperatures under which these studies were made are probably similar to those within the deep burrows in which this tortoise spends most of its time.

DEVELOPMENT OF LARVAE IN OTHER HOSTS.

Four attempts to rear larvae in wounds of sheep and goats proved unsuccessful. A gravid female deposited 15 larvae in a wound on a goat infested with larvae of *Cochliomyia americana*, but the larvae did not develop. In the three other attempts in which 15 to 50 larvae were placed in fresh artificial wounds on sheep and goats, the larvae failed to become established.

Efforts to rear the larvae in an artificial wound on an alligator were unsuccessful. Two larvae out of 20 lived until the fifth to seventh day, but showed little or no growth.

One attempt to rear larvae on an artificial medium failed. Approximately 15 larvae placed on fresh fish died within 36 hours.

ECONOMIC IMPORTANCE.

Sarcophaga cistudinis is probably of little economic importance, although it may be a factor in keeping the gopher tortoise, and possibly other turtles, in check. The tortoises and turtles damage pastures and truck crops in certain areas, and several

reports of tortoises having been killed by larvae have been called to the writer's attention. One dead tortoise heavily infested with larvae was found by B. V. Travis. One medium-sized tortoise experimentally infested died apparently as the result of an infestation of 105 larvae.

Hall gives records on 136 turtles collected in Georgia over a three-year period. Approximately 25 per cent of these turtles were infested, the average number of larvae in each infestation being 16. In only a small percentage of the turtles was the infestation large enough to cause death.

DESCRIPTION OF THE LARVAL INSTARS.

The descriptions of the larvae are based on examination of mounted and unmounted specimens.

There are three larval instars. As in other species of higher Diptera, the first instar can be readily distinguished from the second and third by the absence of external anterior spiracles, by the appearance of the cephalopharyngeal mechanism (figures 2, 4 and 7), and by a number of other characters. The second-instar larvae are readily distinguished from the third by the posterior spiracles. The second-instar larva has only two spiracular slits in each plate, whereas the third-instar larva has three. Other differences are readily apparent in figures 3 to 8.

First instar.

The larva is rather slender, widest near the middle and tapering to each end (figure 1). There are 12 apparent segments, including the cephalic segment. The length and width of fully relaxed, newly deposited larvae are, respectively, 2.20 mm. and 0.35 mm. (average of 8). At the time of molting the length is approximately 4 mm. The body is well armed with spines. Completely encircling bands of spines at the anterior margin extend from segments 2 to 10, while the spines on segment 11 are greatly reduced or absent on the dorsum. The bands of spines on the dorsum and dorsolateral surfaces become narrower and the individual spines become smaller and lighter in color on each succeeding segment. The spines on the ventral surface are reduced on the last three segments. Spines are present on the posterior margin on segments 11 to 3, but are not so numerous as those on the anterior margin. Spines on the posterior half of segment 2 are more often reduced to a single patch of 2 to 5 on the dorsolateral surfaces, although a few spines are present on the dorsum of some specimens. The spines on the posterior half of the segments are situated farther from the margin than in other Sarcophagidae.

The spines on the anterior border of all the segments are directed posteriorly. The spines on the posterior half of segments 2 to 7 are directed posteriorly, while those on segments 9 to 12 are directed anteriorly; on segment 8 they may point in either direction.

All spines have a single point. In each band laterally and dorsally at the anterior margin of segments 2 to 6 there are 2 or 3 irregular rows of larger

spines, and posterior to these short rows of about 3 to 8 closely approximated smaller spines. On segments 7 to 11 laterally and dorsally the spines are arranged in short, almost straight, rows of 3 to 6 small spines. The spines become smaller on each posterior segment. The ventral spines on segments 2 to 4 are similar to those on the lateral and dorsal surfaces, but those on segments 5 to 11 are larger, at least in the anterior rows. On the posterior half of the segments there are short rows of small, closely approximated spines.

The two posterior spiracles consist of pairs of slits which open into the brownish pigmented spiracular atria. The pigmented atria measure approximately 120 to 200 microns, depending on the size of the larva.

The cephalopharyngeal mechanism is shown in figure 2. The oral hooks are paired, and each hook is divided so that it has two points (instead of the usual one), the upper smaller than the lower and turned slightly inward. The length of the cephalopharyngeal mechanism from the tip of the oral hooks to the posterior extremity of the dorsal cornu is 0.312 to 0.354 mm., or, for an average of 6 specimens, 0.327 mm. The width at the widest point is 0.104 to 0.114 mm., or, for an average of 6 specimens, 0.106 mm.

Second instar.

The length of the larva ranges from approximately 4.2 to 9.5 mm., and the width from 0.9 to 1.8 mm. Complete or laterally interrupted bands of spines at the anterior margin of the segments extend from segments 2 to 10 (figure 3). Each band is composed of 3 or 4 irregular rows of spines. On segment 11 spines are absent on the dorsum. Near the center of each segment are scattered spines arranged in irregular rows. On segments 3 to 10 these spines form a completely encircling band, but they become less numerous towards the posterior end, especially on the dorsal half, and generally are restricted to the ventral and dorsolateral surfaces on segment 11 and to the anal area on segment 12. All the spines in the second-instar larva are similar in structure and arrangement. The larger spines measure approximately 0.027 mm. in length.

The anterior spiracles, although smaller, are similar in structure to those of the third instar shown enlarged in figure 6. The number of branches ranges from 16 to 23.

Each of the posterior spiracles (figure 5) has two spiracular slits surrounded by an incomplete ring or peritreme. The length and width of posterior spiracles are approximately 0.145 and 0.115 mm., respectively. Although smaller, the general appearance of the last segment is similar to that of the same segment in the third instar (figure 9).

The cephalopharyngeal mechanism is as shown in figure 4. The structure of these sclerites is typical of the family Sarcophagidae, the dorsal cornu being divided. The length of the cephalopharyngeal sclerites from the tip of the oral hooks to the posterior extremity is 0.630 mm. (average of 4 specimens). The width from the dorsal edge to the ventral edge midway between the narrowed portion of the cephalopharyngeal sclerites is 0.175 mm.

Third instar.

The third-instar larva is shown in figure 6. The length and width of the larvae in this instar are approximately 10 to 15 mm. and 2 to 4.5 mm., respec-

tively. The larva is heavily armed with spines (figure 6) well distributed on the segments. In other species of Sarcophagidae the spines are restricted to either the anterior or the posterior margin of the segment, the central portion being devoid of true spines. The anterior margin of segments 2 to 10 is provided with a complete band of 2 to 4 rows of spines. Segment 11 has 1 or 2 rows of spines, generally, but not always, complete on the dorsum. The spines situated on other parts of the segments show great variation in distribution. They are present on segments 3 to 12, and generally completely encircle segments 3 to 5, but they may be absent on the dorsum of all the segments or they may encircle segments 3 to 7. Spines on the sides may be absent or reduced on some of the more posterior segments. The spines are light to dark brown, rather broad at the base, and taper to a somewhat flattened point.

The two anterior spiracles, located one on each side of segment 2, are shown enlarged in figure 6. In 18 specimens the number of branches ranged from 16 to 23, the average number being 19.

The structure of the last or twelfth apparent segment is shown in figure 9. The two posterior spiracles are situated in the shallow posterior cavity. The tubercles bordering the posterior cavity, both above and below, are reduced to mere vestiges in this species. Numerous small unpigmented spines arranged in interrupted rows are present on the border of the posterior cavity. The anal protuberance and the tubercle on each side of the anal area are greatly reduced.

The posterior spiracles are as shown in figure 8. The length and width of the spiracular plates are approximately 0.31 and 0.29 mm., respectively.

The cephalopharyngeal mechanism is as shown in figure 7. Its length is 1.28 mm., and its width from the ventral to the dorsal edge half way between the narrowed portion of the pharyngeal sclerites is approximately 0.33 mm.

SYSTEMATIC RELATIONSHIP.

The genus *Cistudinomyia* was erected by Townsend (*7*) for the species *cistudinis*, but this classification has not been generally accepted.

The larvae of *Sarcophaga cistudinis* have many morphological characteristics uncommon to other species in the genus *Sarcophaga*. On the basis of these differences it seems well to consider a separate genus for the species. The writer believes, however, that the acceptance of a new genus should also be justifiable on the basis of adult characteristics and that this question should be decided by students of the adults of the family Sarcophagidae.

SUMMARY

Sarcophaga cistudinis Ald. is a larval parasite of turtles and tortoises. The life history of this parasite in the common gopher tortoise (*Gopherus polyphemus*) and also descriptions of the different larval instars are presented in this paper.

The prelarviposition period at a mean temperature of 76° F. ranges from 8 to 10 days.

The flies prefer to larviposit on wounds of tortoises already infested with larvae. The flies may deposit from 121 to 140 larvae.

Larval infestations on tortoises may start from larvae penetrating the skin, but data are presented which indicate that the tortoise tick (*Amblyomma tuberculatum* Marx) is one predisposing factor. The larvae may start an infestation at the site of attachment of ticks or may enter through old scars where ticks have previously been attached.

The duration of the various larval instars was found to be as follows: First instar, 7 to 11 days; second instar, 7 to 9 days; third instar, 28 to 35 days. The total developmental period of the larvae was found to be 43 days in one tortoise and 52 days in another. The duration of the pupal period ranged from 17 to 18 days. The complete developmental period of all stages, including the prelarviposition period of the adult, was 69 days in one case and 81 days in another.

The fall generation of this species may overwinter as larvae in the host.

Efforts to rear the larvae on goats, sheep, an alligator, and an artificial medium (fish) failed.

It is suggested that *Sarcophaga cistudinis* may be a factor in keeping tortoises in check. Except for its possible value in this respect, the species appears to be of no economic importance.

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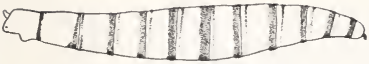
Explanation of Figures, Plates 6 and 7.

Figure 1. Lateral view of first-instar larva. Arrangement of spines partly diagrammatic.

Figure 2. Lateral view of cephalopharyngeal sclerites of first-instar larva.



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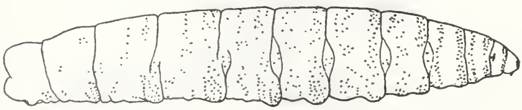

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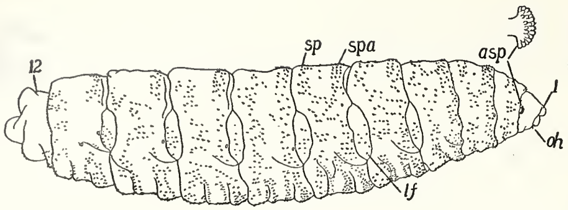

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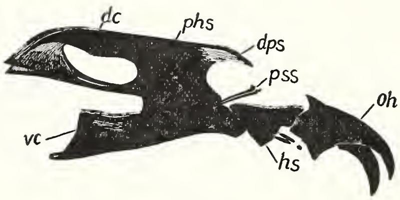

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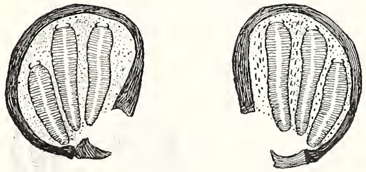

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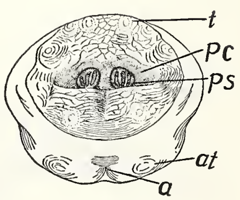

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Figure 3. Lateral view of second-instar larva.
Figure 4. Lateral view of cephalopharyngeal sclerites of second-instar larva.
Figure 5. Posterior spiracles of second-instar larva.
Figure 6. Lateral view of third-instar larva. 1, First apparent or cephalic segment; *oh*, oral hooks; *asp*, anterior spiracles; *spa*, spines on anterior margin of segment; *sp*, spines on posterior margin of segments; *lf*, lateral fusiform area; 12, twelfth segment.
Figure 7. Lateral view of cephalopharyngeal sclerites of third-instar larva. *oh*, oral hooks; *hs*, hypostomal sclerites; *pss*, parastomal sclerites; *dps*, dorsopharyngeal sclerites; *phs*, pharyngeal sclerites; *dc*, dorsal cornu; *vc*, ventral cornu.
Figure 8. Posterior spiracles of third-instar larva.
Figure 9. Posterior view of twelfth or last apparent segment of third-instar larva. *pc*, posterior cavity; *ps*, posterior spiracle; *a*, anus; *at*, anal tubercle; *t*, tubercle on border of posterior cavity.

STUDIES IN CERTAIN GENERA OF AMERICAN BLATTIDAE (ORTHOPTERA).

By Ashley Buell Gurney
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This is the first of a series of short papers dealing with American roaches, largely tropical in distribution, in the United States National Museum. Some of the new species were examined by Mr. A. N. Caudell, prior to his death, and set aside for further study; others have been received more recently in quarantine interceptions or have been detected in unstudied material.

During a recent visit to the Academy of Natural Sciences of Philadelphia the facilities and collection of that institution were placed at the disposal of the writer by Mr. J. A. G. Rehn, and grateful acknowledgment of that courtesy is here made. The writer would also express his especial indebtedness to Mr. Morgan Hebard for the privilege of examining material in the latter's collection and for personal advice and assistance.

In this paper the genera *Aglaopteryx*, *Attaphila*, *Nauclidas*, and *Poroblatta* are discussed. In addition to supplying distributional records of previously known and descriptions of new species, a survey of each genus is made, with a key to all known species whenever practical. In this and following papers of this series, the genera treated are not necessarily chosen in phylogenetic sequence, but according to the availability of unrecorded material and the extent of the writer's study of certain groups. Thus, new species in such large genera as *Neoblattella* will not be described until it is possible to study the entire genus rather completely.

The Genus **AGLAOPTERYX** Hebard.

Aglaopteryx Hebard, Mem. Amer. Ent. Soc., No. 2, p. 30, 1917 (genotype, *A. gemma* Hebard, by original designation).

Aglaopteryx is closely related to *Euthlastoblatta* Hebard, and though the general appearance of the two genera is considerably different it is difficult to give constant characters for use in a key. One character common to the two genera, the possession of pulvilli only on the fourth tarsal segment, must be interpreted with care when separating them from related genera, as the ventral apices of the three basal segments of dry specimens sometimes appear white and like small pulvilli.

The tegmina of all known species of *Aglaopteryx* have a distinct brown design on a light background and all except *lita* Hebard have a characteristic pronotal design of dark upon light, whereas *Euthlastoblatta*, as now known, is essentially dark. The male subgenital plate is ordinarily much more developed, with more conspicuous styli, in *Aglaopteryx* than in *Euthlastoblatta*, and in some cases the proximal spines of the ventro-anterior margin of the anterior femur are so small as to be seen with difficulty, in contrast to the rather strong spines of *Euthlastoblatta*.

In addition to the presence of pulvilli only on the fourth tarsal segment, important generic characters of *Aglaopteryx* include the following: Ventro-anterior margin of anterior femur with spines decreasing suddenly in size, terminated by two elongate spines; ventral margins of middle and hind femora armed with elongate, moderately stout spines; tarsal claws and dorsum of male abdomen unspecialized; arolia present; branches of median vein of tegmen, when present, oblique; intercalated triangle of wing very small.

When *Aglaopteryx* was erected only two species were known. Later, *lita* Hebard (Mem. Amer. Ent. Soc., No. 4, p. 33, Pl. 2, figs. 14, 15, 1919) was described from Panama and more recently Rehn (Trans. Amer. Ent. Soc., Vol. 58, pp. 103–118, 1932) has revised the Bahaman, Bermudan, and West Indian complex, adding four more. The two species here described and others in the National Collection, still undescribed because males are lacking or because of poor condition, indicate that a considerable group is involved.

The new species, *notabilis*, is the first record of the genus from the mainland of South America, but such a southward extension within the tropics does not seem unlikely. The unique type, however, may have been carried in commerce.

As suggested by Rehn in 1932, a practical key to the species is difficult to prepare because of the complicated and highly important male genitalia. The following key may be used best in conjunction with previous literature on the genus.

Key to Species of Aglaopteryx.

1. Pronotum all dark except anterior and lateral margins. (Panama).... *lita* Hebard.
   Pronotum light with dark discal markings..........2
2. Design of pronotum composed of two lateral stripes, connected anteriorly, and a mesal anchor-like figure with its arms connected to the lateral stripe on each side. (Of the general type shown in fig. 5)..........3
   Design composed of two lateral stripes, not connected anteriorly, and without anchor-like figure or, if with an indication of one, the arms not connected to the lateral stripe..........5
3. Tegmina not reaching beyond middle of abdomen, subquadrate; wings absent; male subgenital plate with left style scarcely developed, right style very blunt, nearly as broad as long. (Southeastern U. S. and Bahamas)..........*gemma* Hebard.
   Tegmina extending beyond middle of abdomen, of general form as in fig. 6; wings well developed; male subgenital plate with left style conspicuous, right style rather pointed, at least twice as long as broad..........4
4. Male subgenital plate as in fig 8; tegmina reaching apex of supra-anal plate[1] (Puerto Rico)..........*absimilis*, new species.
   Male subgenital plate not as in fig. 8; tegmina leaving three caudal abdominal tergites exposed. (Bermuda)..........*occulta* Rehn.
5. Lateral margins of pronotal stripes very irregular, as in fig. 3; face with a conspicuous dark transverse bar. (Southeastern Brazil).... *notabilis*, new species.
   Lateral margins of pronotal stripes evenly curved; face lacking a transverse bar..........6
6. Tegmina leaving five abdominal tergites exposed; penultimate segment of maxillary palpus strongly infundibuliform, about twice as long as apical breadth; face with two small dark spots. (Jamaica).... *vegeta* Rehn.
   Tegmina reaching nearly to or slightly beyond apex of abdomen; penultimate segment of maxillary palpus less strongly infundibuliform; face with no conspicuous markings..........7
7. Size large for the genus (length of body 12 mm. or more); width of occipital interocular space (cephalad) about four-fifths that between antennal scrobes; mesal margins of pronotal stripes practically straight except for a small notch. (Cuba)..........*mira* Rehn.

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[1] The statement that a supra-anal plate is absent in Blattidae and Mantidae appears in a recent paper by the author (Jour. N. Y. Ent. Soc., Vol. 44, p. 298, 1936). As Snodgrass has noted (Principles of Insect Morphology, p. 254, 1935), the dorsal apex in Blattidae belongs to the tenth segment, while in Acrididae it represents the eleventh segment. In strict morphological terminology, "supra-anal plate" refers to the eleventh segment only, though taxonomists use the term for the apical flap-like covering of either the tenth or the eleventh segment.

Size normal (body less than 12 mm.); interocular space narrower than indicated above; mesal margins of pronotal stripes with one or more broadly rounded emarginations........8

8. Posterior end of each pronotal stripe with a short mesal extension, resulting in a doubly emarginate margin; male subgenital plate with no appendage laterad of each style; left style extremely broad and blunt. (Puerto Rico)........*devia* Rehn.

No mesal extension of pronotal stripe; male subgenital plate with an appendage laterad of each style; left style decidedly slender and acuminate. (Cuba)........*diaphana* (Fabricius).

Aglaopteryx absimilis, new species (figs. 5, 6, 7, 8).

Male.—General form short, flattened, ovate; surface moderately polished, tegmina and wing barely surpassing supra-anal plate, leaving exposed apex of subgenital plate and at least one-half the length of cerci.

Head almost entirely concealed from above, compound eyes prominent; interocular space narrower than distance between antennal scrobes, about equal to length of basal two segments of antenna. Maxillary palpus reaching to apex of front coxa; antepenultimate segment slender, cylindrical, about equal to apical and longer than penultimate segment, the latter somewhat infundibuliform. Basal segment of antenna not conspicuously swollen at tip; third segment elongate, longer than second; several succeeding segments transverse, then grading from quadrate to slightly elongate near apex.

Pronotum shaped as illustrated (fig. 5); lateral margins sloping along anterior margin so as to fit curve of occiput. Tegmen as in fig. 6; costal field with about 13 veins reaching margin; median vein with at least five oblique branches evident. Wing as broad as long; about eight well defined costal veins, not noticeably clubbed; median vein forked twice near apex, reaching margin in three places; ulnar vein also with two branches from main stem, all reaching margin; seven short transverse veins going to the anal sulcus from ulnar vein distad of basal fork. Intercalated triangle scarcely evident. Legs typical of the genus; proportions of tibia, tarsal segments, and basitarsus of posterior leg as 31 : 23 : 12.

Supra-anal plate emarginate at apex, appearing in ventral view as in fig 7, with a projecting genital hook. Subgenital plate with conspicuous styles and median projections as shown in fig. 8. Within the genital chamber dorsad of the subgenital plate is a sharp, strong hook which curves toward the right. Cerci rather large, flattened, apices acute.

Coloration.—Pronotum delicately margined with light brown, lateral expansions transparent, design in rich dark brown (fig. 5). Tegmen cloudy, scarcely transparent, streaks of pale brown between costal veins, design dark brown, paler along posterior margin. Wing veins largely pale, somewhat darkened in a broad subapical band and in anterior anal field. Eyes black; interocular space dark brown, grading into buff on occiput; remainder of head a very pale buff except for brown at frontal pits and basimandibular membrane. Antennal segments beyond the second marked with brown. Ground color of legs pale; bases of middle and hind coxae and dorsal margin of front femur brown; dorsal margins of tibiae and ventral margin of hind femur conspicuously spotted with

brown at bases of spurs. Thoracic pleura dark at bases, the dark color extending along margins of coxae. Mesonotum white; mesal posterior margin, double mesal bars extending longitudinally, and a spot centrally located in each lateral half brown. Metanotum white except for two short mesal longitudinal brown bars. Dorsum of abdomen brown, slightly mottled with buff. Ventral surface darker at lateral margins; subgenital plate amber. Cerci mostly white above; extreme bases, apices, and most of ventral surface brown.

Measurements.—Length of body 8.5 mm., of pronotum 2.53, of hind tibia 3.15, of tegmen 6.3; width of pronotum 3.96 mm., of tegmen 2.55.

Type locality.—Cayey, Puerto Rico.
Type No. 52012 U. S. N. M.
A single adult male collected March 16, 1917, by R. T. Cotton.

Aglaopteryx notabilis, new species (figs. 1, 2, 3, 4).

Female.—General form large and robust; supra-anal plate and the two preceding tergites exposed. Tegmina and pronotum polished. Head similar to that of *absimilis;* penultimate segment of maxillary palpus slightly infundibuliform but not nearly as strongly so as in *vegeta.*

Pronotum as shown in fig. 3, gently convex, imperfectly transparent near lateral margins. Tegmen of same texture as pronotum, form as figured (fig. 1); 12 costal branches reaching margin; seven oblique branches of median vein evident; apex of anal sulcus broadly recurved, prominent. Wing of same general form as in *absimilis;* about 10 costal veins, slightly clubbed; median vein forked a short distance beyond middle of wing, each branch once forked; ulnar vein simple; numerous transverse veins connecting longitudinal veins anterior to anal sulcus; intercalated triangle scarcely evident; first three veins of anal field conspicuous, arising from a triple fork of first anal vein.

Front femur as figured (fig. 2), ventro-anterior margin with three small, inconspicuous spines followed by a row of regularly spaced, minute spines; two strong, curved, apical spines; ventro-posterior margin bearing a number of weak and irregularly spaced, minute spines; a small apical spine. Armature of other legs equally typical of genus. Proportions of tibia, tarsal segments, and basitarsus of hind leg as 43 : 37 : 20.

Supra-anal plate triangular in general outline, a median longitudinal ridge evident, apex emarginate as shown in fig. 4; margin sparsely clothed with setae. Subgenital plate scoop-like, surpassing supra-anal plate, apex pointed. Cerci typical of genus.

Coloration.—Pronotum pale straw-colored, delicately margined with light buff, design in rich brown as in fig. 3. Tegmen of color shades as in *absimilis,* design as figured (fig. 1). Wing with tips of five veins at apex conspicuously brown, superficially giving a clubbed appearance, anterior anal veins noticeably darkened. Eyes mottled brown and black; interocular space brown, abruptly contrasted anteriorly to a narrow interocellar band of pale buff and grading posteriorly into mottled buff on occiput. A conspicuous narrow band of dark brown connecting ventral extremities of compound eyes, extending in a broad curve reaching up between the antennal sockets. Ground color of legs yellow

buff; coxae with black at bases and in a narrow submarginal strip along exterior margin. Tibiae and middle and hind femora blotched with dark brown at bases of spurs; posterior margins of femora, apices of tibiae, and bases of tarsal segments dark brown. Thoracic pleura marked with dark brown. Meso- and metanota sordid gray, the former with two mesal longitudinal dark bars extending from beneath pronotum. Dorsum of abdomen mottled brown; supra-anal plate pale, except on either side at base, setae light amber. Ventral surface mottled, darker on lateral margins, sternites spotted with brown mesally; subgenital plate dark brown, a small pale area on each side of extreme apex. Cerci largely pale except at base.

Measurements.—Length of body 12 mm., of pronotum 3.60, of hind tibia, 4.68, of tegmen 7.5; width of pronotum 5.41 mm., of tegmen 3.64.

Type locality.—Itapemirim, Brazil, South America.

Type No. 52013 U. S. N. M.

A single adult female collected in 1908.

In the Pseudomopinae it is usually considered a conservative policy to describe species only when males are present. In this case, however, the features of size, facial pattern, and pronotal design appear sufficiently distinctive to warrant description from the female alone.

The Genus **ATTAPHILA** Wheeler.

Attaphila Wheeler, Amer. Nat., Vol. 34, No. 407, pp. 851–862, 1900 (genotype, *A. fungicola* Wheeler, by monotypy).

Important generic characters of *Attaphila* include the following: Form elliptical, surface clothed with scattered hairs; all antennal segments except second and third longer than wide; tegmina and wings absent in female, reduced or absent in male; ventral margins of anterior femora unarmed except for a few hairs and a delicate terminal spine; middle and hind femora each with a strong genicular spine; large arolia present.

The genus *Attaphila* as now known contains the following species: *fungicola*[2] Wheeler, 1900, Texas; *bergi* Bolivar, 1901, Argentina and Uruguay; *sexdentis* Bolivar, 1905, Brazil; *schuppi* Bolivar, 1905, Brazil; *bergi* var. *minor*[3] Bruch, 1916, Argentina.

Attaphila flava, new species (fig. 9).

The general form of the male is as in *fungicola* Wheeler, from which it differs noticeably in the structure of the subgenital plate (fig. 9). It is less closely allied to *bergi* Bolivar, from which it differs in the tapering, less quadrate abdomen, triangular supra-anal plate, and asymmetrical subgenital plate.

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[2] See Hebard, M., Mem. Amer. Ent. Soc., No. 2, pp. 212–215; pl. 10, figs. 5–6, 1917, for the most recent complete diagnosis of *fungicola* and a discussion of generic characters.

[3] Bruch, C., Revista del Museo de la Plata, t. 23 (segunda serie, tomo 10), pp. 329–331, fig. 17, A–F, 1916.

Male.—Head triangular; antennal sockets deeply excavated. Antennal segments 2 and 3 as wide as long; others elongate. Compound eyes inconspicuous. Labial palpus minute. Maxillary palpus with apical segment longer than subapical.

Pronotum hood-like, concealing head from above. Tegmina of same form as in *fungicola*, barely overlapping at inner margins, slightly exceeding margins of abdomen at sides, exposing base of abdomen. No wings visible. Femora short and stout; a curved genicular spine present on middle and hind femora; hind femur deeply excavated along posterior margin for reception of tibia. Tibiae strongly armed with spines in contrast to weakly armed femora. Tarsal claws minute; arolia large.

Abdomen with eight visible dorsal segments posterior to tegmina; dorsal surface unspecialized. Cerci and supra-anal plate as in *fungicola*. Subgenital plate as figured. Body sparsely covered with fine hairs.

Coloration.—General color amber yellow, tegmina and legs a noticeably darker shade than pronotum and abdomen. Arolia and labial palpi white.

Measurements.—Length of body 2.83 mm., of pronotum 0.97, of tegmen 0.81, of hind tibia 0.53; width of pronotum 1.57 mm., of tegmen 1.26.

Type locality.—Botanic Gardens, Belize, British Honduras.
Type No. 52014 U. S. N. M.
A single adult male collected by P. G. Goll, July 11, 1904.

The Genus **POROBLATTA** Hebard.

Poroblatta Hebard, Trans. Amer. Ent. Soc., Vol. 45, p. 123, 1919 (genotype, *P. cylindrica* Hebard, by original designation).

The subfamily Perisphaerinae as found in America has several rather marked generic complexes. The genera exemplified by *Hormetica* Burmeister are typically winged in both sexes and the pronotum is frequently heavily sculptured. *Hormetica* has close affinities with the Panchlorinae. *Antioquita* Hebard and *Litopeltis* Hebard are very like Epilamprinae and, as Hebard (Trans. Amer. Ent. Soc., Vol. 59, p. 27, 1933) has suggested, the correct subfamily placement of all tropical American species now assigned to the Perisphaerinae may not yet have been determined.

The complex to which *Poroblatta* belongs contains several genera possessing for the most part[4] males with fully developed tegmina, and females having the tegmina very short or entirely absent (as in *Acroporoblatta* Hebard, 1919). The species of *Poroblatta* apparently live as borers in stumps and logs in a manner similar to those of *Cryptocercus* Scudder in the United States.

[4] See Rehn, J. A. G., Trans. Amer. Ent. Soc., Vol. 56, p. 58, 1930, for the description of *Nauclidas*, the male of which has abbreviate tegmina, and a discussion of associated genera.

The two new species here described differ sufficiently in the general shape of the body and form of the pronotum to be ineligible for placement in *Galiblatta* Hebard or *Colapteroblatta* Hebard, while the presence of arolia eliminates *Styphon* Rehn, which has none, from consideration; nor can the present species properly be referred to *Nauclidas* Rehn, because they lack the strongly roughened, punctate integumental surface characteristic of that genus.

The following key is based on the female sex because all known species of *Poroblatta* were originally described from the females and only recently have the males of some of the species been associated with their mates.

KEY TO THE SPECIES OF *Poroblatta* BASED ON THE FEMALE SEX.

1. Tegmen a lateral pad having the apical mesal margin convex or straight oblique, not roundly emarginate; basal mesal margin one-fourth or less the length of apical mesal margin, not extending to base of metanotum 2

   Tegmen having apical mesal margin slightly to very broadly emarginate; basal mesal margin at least one-half the length of apical mesal margin, extending from pronotum to base of metanotum 3

2. Tegmen bluntly lanceolate, extending less than one-half the distance across the metanotum; dorsal surface of body almost uniformly blackish brown. (Venezuela) .... *pluto* Rehn.

   Tegmen subtriangular, extending to the base of the second abdominal tergite; lateral margin of pronotum and costal margin of tegmen distinctly lighter in color than remainder of dorsal surface. (Colombia) .... *cylindrica* Hebard.

3. Dorsal surface blackish chestnut brown with a distinct band of lighter color one-third the width of tegmen along the costal margin of tegmen and lateral margins of pronotum; shape of tegmen not as in fig. 12 4

   Dorsal surface black with faint suggestion of lighter color along the costal margin of tegmen and at anterior-lateral angles of pronotum; shape of tegmen as in fig. 12. (Colombia) .... *caudelli*, new species.

4. Tegmen roundly emarginate to a greater extent than shown in fig. 12; lighter coloration of costal margin of tegmen extending along dorsal surface of abdomen as a pale marginal area one-fourth the width of abdomen (length of type 26 mm.). (Colombia) .... *apatela* Hebard.

   Tegmen hardly emarginate, as shown in fig. 10; dorsum of abdomen of uniform coloration (length of type, 21 mm.). (Colombia) .... *bicolor*, new species.

Poroblatta caudelli, new species (figs. 11, 12).

This species is nearest *pluto* in coloration and *apatela* in form.

Female.—General form elongate, convex. Surface finely but conspicuously punctate, more deeply punctate on pronotum than on dorsum of abdomen.

Head entirely concealed from above, shape typical of the genus. Vertex plainly and densely punctate; coronal suture and frontal sutures leading to ocelli visible. Ocelli inconspicuous. Compound eyes slightly more distant than antennal sockets. Apical segment of maxillary palpus longer than penultimate segment, the latter noticeably swollen at apex. Basal segment of antenna elongate, curved at base; third segment three times as long as wide; second slightly less than twice as long as wide; other basal segments globular to quadrate; apical segments elongate.

Pronotum markedly hood-like; a definite dorsal marginal line present throughout; anterior lateral angles broadly rounded; posterior lateral angles rather abruptly rounded, rectangulate; posterior margin practically truncate. Tegmen as shown in fig. 12; strongly sclerotized, not attingent mesally, broadly rounded at apex of costal margin, humeral trunk apparent but feeble; punctures of tegmen arranged in concentric arcs mesad of humeral trunk. No wings visible. Legs typical for the genus; anterior surface of front tibia and apex of femur as in fig. 11.

Abdomen less convex than pronotum; segments well defined. Venter of abdomen smooth, most noticeably punctate along lateral margins. Sternite immediately basad of subgenital plate with posterior margin broadly emarginate; other sternites very slightly to not at all emarginate. Subgenital plate covering all of ventral surface of abdomen beyond sixth tergite, slightly roundly emarginate opposite cerci, apex broadly rounded. Supra-anal plate and cerci as figured (fig. 12), typical of the genus.

Coloration.—Dorsal surface black, faintly tinged with buff at anterior lateral angles of pronotum and along costal margins of tegmina. Compound eyes chocolate brown, vertex blackish brown, ocellar area, genae, mandibles, and labrum yellowish buff; clypeus black, margins pale. Frons deep black, the black color extending with same intensity to frontal sutures. A conspicuous black spot below each antennal socket marking a muscle attachment (the myociacatrix of Crampton) of tentorium. Basal 10 segments of antenna buff, others dark brown. Legs yellowish buff, spines somewhat darker, black at extreme apex; middle and hind coxae dark brown basally and with a short, median, tongue-shaped extension, reaching one-third to one-half the length of the area, which receives the femur in repose; margins of coxae and femora and apices of tibiae and tarsal segments light brown. Ventral abdominal surface grading from pale buff at base to black at apex of subgenital plate. Supra-anal plate black; cerci black, each with a small spot of buff near apex.

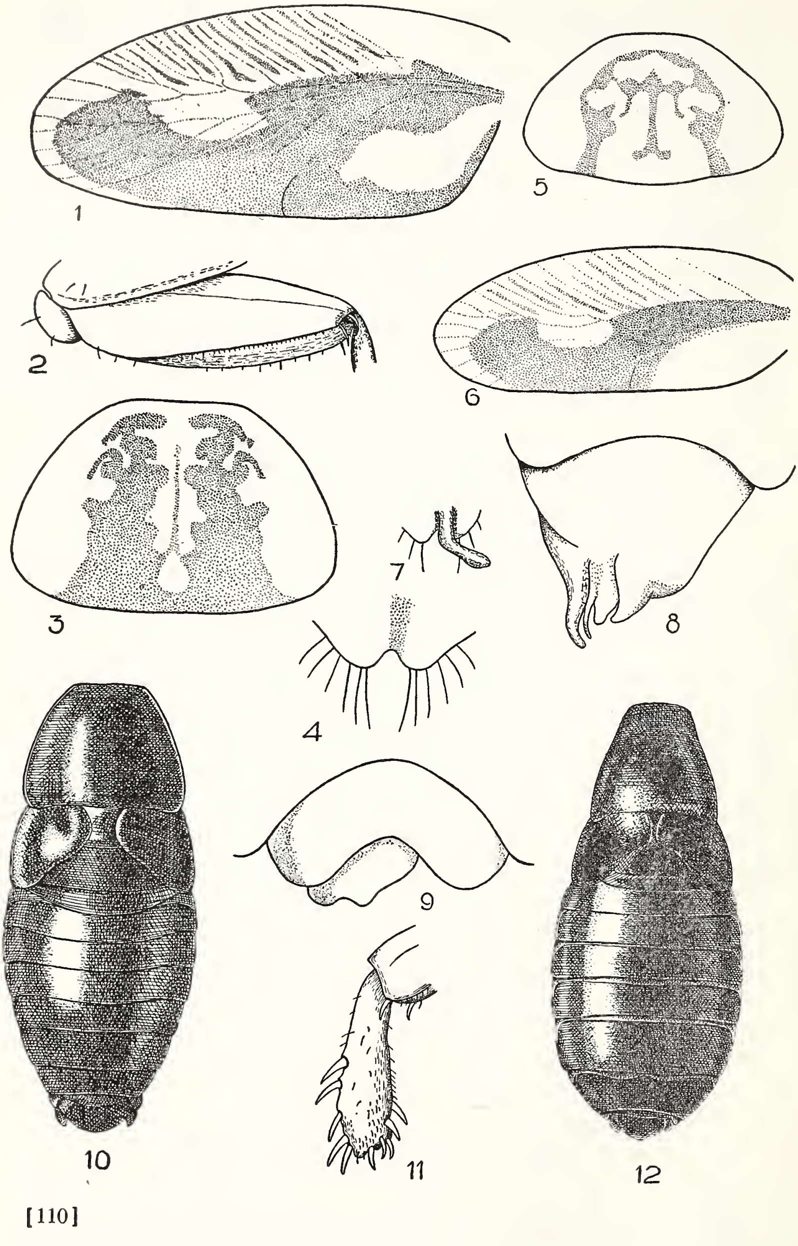
Measurements.—Length of body 21.5 mm., of pronotum 6.1, of tegmen 3.7, of hind tibia 4.5; width of pronotum 7.0 mm., of tegmen 5.0; interval mesad between tegmina 0.6.

Type locality.—Colombia, South America.

Type No. 52015 U. S. N. M.

A single adult female intercepted at Washington, D. C., in orchids from Colombia, August 7, 1936; Identification Lot No. 36–25793.

It is a pleasure to name this new species in memory of the late Mr. Andrew Nelson Caudell.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Poroblatta bicolor, new species (fig. 10).

Female.—In general form close to *apatela.* Punctures on dorsum of abdomen scarcely noticeable, delicate but definite on thoracic nota and tegmina. Head of same form as in *caudelli*, vertex visible to a small extent from above, remainder concealed by pronotum. Vertex and interocular space smooth and shining; impressed punctures decidedly fewer than in *apatela* and *caudelli.* Compound eyes and appendages of the head as in *caudelli.* (The type of *bicolor* has only the basal segment of each antenna present.)

Pronotum decidedly less convex than that of *caudelli* and differing in proportions of width and length as indicated by the figures and measurements given. Tegmina as shown in fig. 10; apical mesal margin almost straight oblique, roundly emarginate to only a small extent; longitudinal humeral trunk indicated: punctures less prominent than in *caudelli.* No wings visible. Abdomen less convex than in *caudelli;* legs and ventral surface of the abdomen similar in the two species; supra-anal plate distinctly punctate, more broadly rounded at apex than in *caudelli;* subgenital plate and cerci typical of genus. (The type of *bicolor* was carrying a protruding ootheca when received and is so mounted.)

Coloration.—Dorsum of abdomen uniformly blackish chestnut brown, shining; mesal areas of thoracic nota and of tegmina somewhat lighter in shade than abdomen, grading into a band of yellowish buff along costal margins of tegmina and lateral margins of pronotum, the latter conspicuously spotted with small brown spots on the light marginal background. Coloration of head differing from that of *caudelli* in being generally lighter and more mottled on vertex and interocular space; frons dark brown rather than a distinct black, intensified color not extending to the frontal sutures; a light brown triangular area delimited by frontal sutures on two sides is marked by three prominent dark spots; location of tentorial muscle attachments below antennal sockets not conspicuous. Legs colored as in *caudelli.* Venter of the abdomen very similar in the two species; subgenital plate lighter in *bicolor*, and lateral margins of sternites lighter and more conspicuously marked with small dark spots. Cerci with extreme tip and basal two-thirds black, subapical portion light buff.

Measurements.—Length of body 21 mm., of pronotum 5.9, of tegmen 3.3, of hind tibia 5.4; width of pronotum 8.3 mm., of tegmen 4.4; interval mesad between tegmina 1.9.

Type locality.—Bucaramanga, Colombia, South America.
Type No. 52016 U. S. N. M.
A single adult female collected by E. P. Killip, 1927.

Nauclidas nigra (Brunner).

Parasphaeria nigra Brunner, Proc. Zool. Soc. London, p. 206, Pl. 15, fig. 7, 1892.

Perasphaeria (error for *Parasphaeria*) *rufipes* Brunner, Id., p. 604, Pl. 52, fig. 3, 1893.

Poroblatta nigra (Brunner), Hebard, Trans. Amer. Ent. Soc., Vol. 55, p. 384, 1929 (synonymy of *rufipes* (Brunner) established).

Nauclidas nigra (Brunner), Rehn. Id., Vol. 56, p. 58, 1930 (synonymy of *rufipes* (Brunner) accepted).

Grenada, British West Indies—One adult female collected by Sebastian Gates, 1933 (U. S. N. M.).

Previous published records are as follows:

St. Vincent—Brunner's type locality of *nigra*.

Grenada—Brunner's type locality of *rufipes*.

St. Lucia—By Rehn and Hebard as *Poroblatta rufipes* in 1927 and Hebard as *P. nigra* in 1929.

Becquia Island—By Hebard in 1929 as *P. nigra*.

Explanation of Plate.

Fig. 1. *Aglaopteryx notabilis*, new species, left tegmen.

Fig. 2. Same, anterior aspect of left front femur including trochanter and portions of coxa and tibia.

Fig. 3. Same, dorsal view of pronotum.

Fig. 4. Same, dorsal view of apex of supra-anal plate.

Fig. 5. *Aglaopteryx absimilis*, new species, dorsal view of pronotum.

Fig. 6. Same, left tegmen.

Fig. 7. Same, ventral view of apex of supra-anal plate and projecting genital hook.

Fig. 8. Same, ventral view of subgenital plate.

Fig. 9. *Attaphila flava*, new species, ventral view of subgenital plate.

Fig. 10. *Poroblatta bicolor*, new species, general dorsal view.

Fig. 11. *Poroblatta caudelli*, new species, anterior aspect of right front tibia and apex of femur.

Fig. 12. Same, general dorsal view.

(Figures 1, 3, 5, 6, 10 and 12 drawn by Mary Foley Benson, others by the author.)

NOTES ON NORTH AMERICAN LYCOSID SPIDERS.

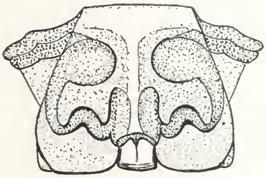
By Irving Fox,

Collaborator, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

The material on which the following paper is based reposes in United States National Museum, to whose authorities I am indebted for the privilege of studying its collections. I wish also to express my appreciation to Miss E. B. Bryant of the Museum of Comparative Zoology and to Dr. W. J. Gertsch of the American Museum of Natural History for permission to examine types of the species synonymized in this paper.

Pardosa pristina, n. sp. (fig. 1).

Female.—Total length, 7.43 mm. Carapace, 3.17 mm. long, 2.48 mm. at the widest place, 1.19 mm. wide in front. Abdomen, 4.26 mm. long, 2.77 mm. wide. Resembling *P. modica* (Blackwall) in coloration and in size but radically different in the structure of the epigynum. Carapace dark brown, with a wide median longitudinal light band which in front is nearly as wide as the third eye-row, narrowing at the posterior border of the *pars cephalica* to two-thirds the anterior width, tapering as it proceeds posteriorly to the caudal border. Sides with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submarginal light bands continuous with the clypeus which is also light. Sternum dark brown with a median longitudinal light stripe, labium also dark brown, the endites and coxae light. Legs basally dark having the femora maculate with black, tibiae with indications of two dark annulae, metatarsi and tarsi light. Dorsum of the abdomen with a basal light lanceolate design that is outlined with black, posteriorly with five pairs of light spots dark at the centers. Sides brown, the venter much lighter.

First row of eyes slightly procurved, the medians separated by more than a diameter, larger than the laterals (4/3), from which they are separated by about one-half a diameter. Second row of eyes wider than the first (23/18), narrower than the third (23/33), the eyes separated from each other by more than a diameter. Posterior eyes separated by about three and one-half diameters, smaller than the eyes of the second row (7/8). Clypeus equal in height to about one and one-fourth times the diameter of an anterior median eye. Tibiae with 2–2–2 spines below. Legs I, 9.48 mm. long (coxae, .81 mm.; trochanters, .36 mm.; femora, 2.28 mm.; patellae, .99 mm.; tibiae, 1.88 mm.; metatarsi, 1.68 mm.; tarsi, 1.48 mm.). Legs IV, 13.23 mm. long (coxae, 1.09 mm.; trochanters, .27 mm.; femora, 2.87 mm.; patellae, 1.09 mm.; tibiae, 2.47 mm.; metatarsi, 3.46 mm.; tarsi, 1.98 mm.). Epigynum consisting of a heavily chitinized triangular plate whose apex is anterior. The septum extends cephalad only one-fourth of the length and is flanked on each side by a slightly wider lobe (fig. 1).

Type locality.—Canada: Female holotype from Soda Lake, Alberta, May 18, 1924, two female paratypes from Edmonton,

Alberta, May, 1924 (Owen Bryant, collector); one female paratype from Whitford Lake, Alberta, May 18, 1924 (Bill MacDonald, collector).

Type.—U. S. N. M. Cat. No. 1250.

This new species may readily be identified by the structure of its epigynum which seems to bear no resemblance to that of any other described North American species in the genus.

Pardosa diuturna, n. sp. (fig. 3).

Female.—Total length, 9.50 mm. Carapace, 4.26 mm. long, 3.46 mm. at the widest place, 1.58 mm. in front. Abdomen, 4.16 mm. long, 3.37 mm. at the widest place. Resembling *P. xerampelina* (Keyserling) in general coloration and structure but larger in size and more robust. Carapace dark brown with indications of a median dorsal lighter area. Eye region darker, the eyes on black spots. Sternum black, labium and endites dark brown below having lighter areas basally. Legs black basally, the femora dark brown with distinct yellowish patches on the lateral surfaces, patellae dark brown with a yellow ring distad, tibiae and metatarsi with three distinct black annulae. Dorsum of the abdomen concolorous with the carapace, without distinct markings, the venter light brown.

First row of eyes slightly procurved, the medians separated by more than a diameter, larger than the laterals (4/3), from which they are separated by about three-fourths of a diameter. Second row of eyes wider than the first (34/25), narrower than the third (34/45), the eyes separated from each other by about a diameter. Posterior eyes separated by about three and one-half diameters, smaller than the eyes of the second row (8/12). Clypeus equal in height to more than one and one-half times the diameter of an anterior median eye. The tibiae with 2–2–2 spines below. Legs I, 12.36 mm. long (coxae, 1.19 mm.; trochanters, .39 mm.; femora, 2.67 mm.; patellae, 1.48 mm.; tibiae, 2.87 mm.; metatarsi, 2.28 mm.; tarsi, 1.48 mm.). Legs IV, 16.72 mm. long (coxae, 1.48 mm.; trochanters, .48 mm.; femora, 3.96 mm.; patellae, 1.48 mm.; tibiae, 3.27 mm.; metatarsi, 4.06 mm.; tarsi. 1.98 mm.). Epigynum closely resembling that of *P. xerampelina* (Keyserling), but differing in the character of the median septum which assumes the shape of an arrow-head as is shown in Fig. 3.

Type locality.—Alaska: Female holotype and female paratype from Muir Glacier, West side, June 12, 1899 (Harriman Expedition, T. Kincaid, collector).

Type.—U. S. N. M. Cat. No. 1251.

The species described above is retained separate from *P. xerampelina* (Keyserling) because of its larger size and different epigynum. Although Keyserling's species is common in Canada and known to occur in Greenland and Labrador, it has not yet been reported from Alaska.

Pardosa tarsalis (Thorell).

Lycosa tarsalis Thorell, 1856, Recensio critica aranearum Sueciarum quas descr. Clerckius, Linnaeus, DeGeerus, p. 53.

Pardosa andersoni Gertsch, 1934, American Museum Novitates, No. 693, p. 16.
Pardosa andersoni Gertsch and Wallace, 1935, American Museum Novitates, No. 794, fig. 10 (no description).

Distribution.—Europe. Siberia. Kamchatka. Iceland.
Record.—Bering Island, July-August, 1897, male (L. Stejneger, collector); Popoff Island, 2 females (no further data).

Pardosa cursoria (C. L. Koch) (fig. 2).

Lycosa cursoria C. L. Koch, 1848, Die Arachniden, Vol. XV, p. 49, Pl. 516, fig. 1450.

Distribution.—Europe. Siberia.
Record.—Bering Island, July-August, 1897, male (L. Stejneger, collector).

Lycosa baltimoriana (Keyserling).

Tarentula baltimoriana Keyserling, 1876, Verh. Zool. Bot. Ges. Wien, Vol. XXVI, p. 632, Pl. VII (I), fig. 16.
Lycosa benedicta Chamberlin, 1925, Bull. Mus. Comp. Zool., Vol. 67, p. 227.

Record.—Virginia, Smith's Island, July 4, 1935, female (W. Howard Ball, collector). Iowa, Sioux City, May 24, 1922, male (T. C. Stephens, collector).

The above synonymy is based on an examination of paratypes of Chamberlin's species from Arizona.

EXPLANATION OF ILLUSTRATION.

Fig. 1. *Pardosa pristina*, n. sp., epigynum.
Fig. 2. *Pardosa cursoria* (C. L. Koch), palpus.
Fig. 3. *Pardosa diuturna*, n. sp., epigynum.

MINUTES OF THE 482D REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

The 482d regular meeting of the Society was held at 8 P. M., Thursday, April 1, 1937, in Room 43 of the Natural History Building of the National Museum. Forty-seven members and twenty-four visitors were present, with N. E. McIndoo presiding. The minutes of the previous meeting were read and approved.

D. J. Caffrey, Corresponding Secretary, announced that the counting and wrapping of back numbers of the Proceedings had been completed. Mr. Caffrey stated that copies of Volume 31, Number 4, for April, 1929, and of Volume 32, Number 8, for November, 1930, are lacking, and that he would be glad to receive these numbers through donation, exchange or purchase, since orders for complete sets cannot be filled until copies of these numbers are available.

At the invitation of the Program Committee, M. C. Lane, Walla Walla, Wash., discussed the work on the Pacific-Northwest Wireworm Project.

The first paper on the regular program, entitled "The Rocky Mountain Spotted Fever Tick," was given by Dr. F. C. Bishopp. Since the material contained in this paper will be published at a later date, no abstract appears here. Discussion followed by Siegler, Wade, Gahan, Gurney and Ewing.

The second paper on the regular program, by Mr. Austin H. Clark, was on "The Butterflies of Virginia."

Mr. Austin H. Clark described the technique followed in making a detailed survey of the butterflies of Virginia. Most of the larger butterflies are recognizable from an automobile traveling at the usual speed. Frequent roadside stops provide information regarding the less conspicuous field and woodland species. Bogs, swamps, and other specialized habitats are thoroughly examined.

The species and subspecies of butterflies now definitely known from Virginia number 132, of which he has taken personally all but seven; four of these have not been recorded from the State within the past hundred years. About two dozen others are known from both north and south of Virginia, or from within a few miles of its borders, and undoubtedly occur within the State.

The Canadian, Transition, Upper Austral, and Lower Austral zones are represented in Virginia. The Canadian zone, represented by islands on the higher mountain tops in the southwest, is characterized by *Polygonia faunus smythi*, a dark southern form of the northern *P. faunus*. The Transition zone, characterized by a number of distinctive species, occupies the higher land in the west, while approximately the eastern half of the State is occupied by the Lower Austral zone, these two zones representing the most important faunal divisions.

In the Lower Austral zone, along the western border of the Dismal Swamp and along the Blackwater and Meherrin rivers, occur more or less isolated colonies of species foreign to that zone, such as *Argynnis diana*, *A. cybele*, and *Satyrodes eurydice*. Characteristic of these localities are also *Enodia creola* and *Amblyscirtes carolina*. In the boggy hollows among the sand dunes west of Cape Henry occurs the typical form of *Atrytone dion*, although the dark southern form of this skipper, *alabamae*, is found in the Dahl Swamp in Accomac County further north.

Mr. Clark noted that although most butterflies are smallest in the mountains and largest near the sea coast, the common blue, *Lycaenopsis argiolus pseudargiolus*, is largest in the mountains and smallest near the coast. He also called attention to the appearance in autumn, especially in dry years, of a modified early spring form of certain species.

The local distribution, seasons, broods, variability, and other features of various species were discussed. (Author's abstract.)

Upon invitation from the chair, W. A. Shands, Oxford, N. C., introduced himself.

Adjournment followed at 9.50.

CATHERINE FORD,
Recording Secretary.

BOOK NOTICE: "THE PIONEER CENTURY OF AMERICAN ENTOMOLOGY."

"The Pioneer Century of American Entomology," by Harry B. Weiss. 320 pp. Mimeographed, quarto, cloth, New Brunswick, N. J. Pub. by Author. 1936. $4.25.

Only those students who over long periods of time have attempted to bring together and arrange data from widely scattered sources over an extensive field of research will be able adequately to appreciate the amount of toil and pains which has been taken in the preparation of this book. It has been for several years a self-imposed labor of love on the part of its author, who says of it ". . . In the following pages I have tried to set forth the facts which show that entomology in this country has a background . . . of observations, . . . ideas, successes and failures." In turning the pages of this volume one notes that it demonstrates the correctness of a statement once made by Dr. John Lord to the effect that History is but the lengthened shadows of certain outstanding individuals. Particularly strong on individual biography, much of this book is taken up with the careers of the earlier entomologists, their work, their scientific societies, and the journals and publications in which their works appear. "No one of importance has been omitted, and there have been included some who have been buried in obscurity for many years." The various chapter subdivisions of the volume, which develop and carry along the story, include treatment of such subject-matter as "Entomology in the accounts of the early travelers, 1588–1723"; "The entomology of early books and papers, 1731–1800"; "The early years of the Nineteenth century, 1800–1817"; "Thomas Say and his contemporaries, 1817–1831"; "From Zimmermann to LeConte, 1832-1845"; "Asa Fitch and other entomologists, 1845–1854"; "The Glover and Osten-Sacken period, 1855–1860"; From Walsh to Cowan, 1860–1865"; "The entomology in agricultural periodicals before 1865"; "Scientific societies, scientific journals, and exploring expeditions contributing to the progress of American entomology"; "Some notes on Canada"; and "Entomology in Europe during the pioneer century in America." With such especial emphasis on personal biography it becomes easy to make or to renew acquaintance with the entomological careers of such workers as Mark Catesby, John Bartram, Paul Dudley, William Byrd, Peter Kalm, Israel Acrelius, Andreae Hesselius, Griffith Hughes, John Ellis, Peter Collinson, Landon Carter, Timothy Matlack, Jonathan Carver, William Bartram, Thaddeus Mason Harris, Benjamin Smith Barton, Robert Lowry, Hugh Williamson, Isaac Weld, William Dandridge Peck, John Abbot, James Edward Smith, Isaac P. Trimble, William Henry Edwards,

Samuel Ackerly, George Henry Horn, Thomas Jefferson, John Lawrence LeConte, Charles Alexander LeSueur, J. A. Lintner, George Ord, F. E. Melsheimer, A. S. Packard, Thaddeus William Harris, S. S. Haldeman, C. S. Rafinesque, Benjamin Silliman; Ebenezer Emmons, Townend Glover, and many others. It is also interesting to note in a work of this kind as to just which of the many insects appear to have received most attention from the early entomologists: These include the Cicada, silkworm, curculio, army worm, grasshopper, Hessian fly, joint worm, canker worm, honey bee, rose bug, peach borer, May beetle, and the like.

It is regretted that the bibliography is so inadequate as to fall considerably below the standard of the remainder of the book and, indeed, is a mere fragment of its possibilities, particularly as the numerous references scattered throughout the text would have been made more readily accessible if assembled in order therein. Also, the index bears evidence of hasty preparation and leaves much to be desired.

These matters, however, are inconsequential when measured up with the general excellence and the permanent value of the book. Not only are its component parts carefully evaluated and due proportions of the text given to the more important and outstanding events, but there is everywhere evidence of careful sifting and condensation of facts. Presented simply and clearly with sympathy, insight, and imagination, the book is charmingly written, and, even to those who might have little real interest in the subject, makes easy reading. The author confesses that he has been possessed by that inner urge which continues to scourge onward the tribe of writers, but the results show a laudable feat of patience, perseverance, and prowess, and the book will have an honored place on the shelf along side other works of well known excellence on the same subject by Howard, Essig, and others. J. S. W.

Actual date of publication, May 27, 1937.

VOL. 39 JUNE, 1937 No. 6

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OF THE

ENTOMOLOGICAL SOCIETY

OF WASHINGTON

PUBLISHED MONTHLY EXCEPT JULY, AUGUST AND SEPTEMBER

BY THE

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THE

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OF WASHINGTON

ORGANIZED MARCH 12, 1884.

The regular meetings of the Society are held in the National Museum on the first Thursday of each month, from October to June, inclusive, at 8 P. M.

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PROCEEDINGS
ENTOMOLOGICAL SOCIETY OF WASHINGTON.

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DR. L. O. HOWARD, 1931.

PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

VOL. 39 JUNE, 1937 No. 6

To

DR. LELAND OSSIAN HOWARD

Honorary President

historian, and sole surviving founder of the

Entomological Society of Washington

this number of the Proceedings is dedicated

on the occasion of his eightieth birthday

June 11, 1937

DR. L. O. HOWARD AND THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

Although the task set your committee by the Society in the preparation of the following article of appreciation was a most pleasant one, the entomological activities of Dr. Howard have been so extensive and varied that the choice of a subject among them proved somewhat difficult. However, since his services to this Society have been so extremely valuable and extensive, the subject of "Dr. L. O. Howard and the Entomological Society of Washington" seemed most fitting as a theme for this occasion.

In February, 1884, a circular call, signed by C. V. Riley, E. A. Schwarz, and L. O. Howard, was issued for a meeting to be held on the 29th of that month at 1700 Thirteenth Street, N. W., Washington, D. C. This meeting resulted in the organization of the Entomological Society of Washington. At this meeting Dr. Howard, the junior member of the trio, was elected its Corresponding Secretary and served in this office for two years, when he became President of the Society.

It was during his term as Secretary that he presented at the meeting of June 4, 1885, the results of pioneer experiments on the gustatory qualities of the teneral adults of the periodical cicada. Among other things he said regarding them, "The most palatable method of cooking is to fry in batter, when they reminded one of shrimp." Then he concludes, rather sadly, "They will never prove a delicacy!"

Dr. Howard's retiring address, presented on the evening of January 6, 1887, was entitled "A Brief Consideration of Certain Points in the Morphology of the Family Chalcididae" and was an early item of a most notable series of studies of the parasitic Hymenoptera, begun in 1879, which gained for him international renown.

Upon retirement from his second term in the Presidency, Dr. Howard, or rather "Mr. Howard" as he was then known, presented, on January 5, 1888, the paper "A Commencement of a Study of the Parasites of Cosmopolitan Insects," in which there were listed, for the first time, the insect and araneid hosts, with their known parasites, together with a bibliography of European and American authors. In his introduction to this he says prophetically that it "will form a record upon which to base the collection and importation of the parasites of a destructive species—an attractive idea which has been often discussed in entomological writings, but seldom carried out with much practical success."

During 1888 and 1889, Dr. Howard, serving the Society as a member of the Executive Committee, published articles on "The Hairy Eyes of some Hymenoptera," and other notes on the order. From 1890 to 1891, he was Second Vice-President and continued to describe Micro-Hymenoptera and to report his investigations of their biologies. In these years he was a frequent and always interesting commentator on the papers presented by Schwarz, who was then most active in publication, Riley, George Marx, and others, and it was at this time that he described the many-sided host relations of Pachyneuron and the habits of the parasitic wasps of the genus Melittobia.

In 1892, Dr. Howard began a 2-year term as Corresponding Secretary of the Society, and it was early in this year that his interesting and important paper on "The Hymenopterous Parasites of Spiders" was presented before it. This was followed, in May, by a note showing that the male of *Xylocopa virginica* survives in hibernation in this locality. Although many of Howard's papers of this period indicate his deep interest in the parasitic Hymenoptera, such subjects by no means monopolized his attention. This is indicated by his "Note on the Mouth Parts of Stenopelmatus" as well as extemporaneous discussions which are proof that he had made a serious study of the mouth parts of the insects of several orders.

On December 1, 1893, he accepted the office of Recording Secretary of the Society, and thus we see that after having served as its ranking officer, he continued to serve it for seven years in a descending scale of official dignity, finally assuming the onerous and relatively humble duties of Recording Secretary! It is a fine commentary on his good nature and devotion to the Society to note that in spite of the fact that he became, in 1894, Chief of the Division, which was shortly to become the Bureau of Entomology, he remained as Secretary to the Society until 1901, or a further period of 7 years, and it may be remarked that the Proceedings were never better reported than during this time.

At the meeting of June 7, 1894, or almost exactly 43 years ago, Dr. Howard presented his first "Review of the Work of the Entomological Society of Washington," in which he summarized in a most satisfactory and able way the activities of the first 10 years of life of this organization. Among the many interesting facts shown by this report are that he was second only to Schwarz and Riley in the number of papers presented before the Society during the period; that the residential membership at the time was 30 and the total membership 133. A condition which has long since been greatly changed, caused him to complain of the paucity of systematic papers and that "but 95 new species and 13 new genera" had been described in the pages of the Proceedings during the first 10 years. A total of only 785 pages were printed in this period as compared with 2049 pages of the most recent decade.

At the conclusion of this valuable historical document Dr. Howard made a plea for the establishment of a permanent publication fund in the Society through bequest by its members and ends this with the following: "Who knows but a clause may be found in the will of some one of the men, who are already active in our Society, which will put us upon a firm financial basis?" Remembering the subsequent generosity of our departed, but still beloved, member, Dr. E. A. Schwarz, one is led to believe that Howard's suggestion may have determined his action, many years later, in contributing to this cause.

A rather amusing episode of the November meeting of 1894 was precipitated by the reading of a paper by that eminent zoologist the late Theodore N. Gill, on a remarkable new family of crabs. Dr. Gill at the time was First Vice-President of the Society and he contended that since "the Crustacea are more closely related to the Insects than are the Arachnida" and since papers on the latter order have been admitted to the Proceedings, his present paper should be published by the Society. Fortunately, this proposal was opposed by Howard, who was supported by Schwarz, and it did not prevail.

The year 1895 was an unfortunate one for the Society as it

was to lose by death three of its most active charter members. The first of these was Dr. George Marx, who died on January 3 of that year, and his obituary was written by Dr. Howard. The second death was that of the virtual founder of the Society, Dr. C. V. Riley, who died on September 14, and although the obituary article appearing in the Proceedings is anonymous it is at least partially the work of Howard's pen. The third death was that of Dr. J. G. Morris, which was announced at the November meeting in 1895.

An interesting innovation occurs in the proceedings of the meeting of January 4, 1895, in the form of an article by Dr. Howard, mainly of economic import, entitled "Notes on the Geographical Distribution Within the United States of Certain Insects Injuring Cultivated Crops."

This is an unusually thoughtful and suggestive paper which answers tentatively the author's own question of "How far will a given injurious insect follow its natural food plant when the geographical range of the latter is extended by artificial means?" He takes as examples such well known pests as the San José scale, the Colorado potato beetle, the asparagus beetle, the larger corn stalk borer, the elm leaf beetle, the harlequin cabbage bug, and others. It may be remarked that many of the inferences drawn at that early date, when the study of ecology was in its embryonic stage, have proven, in the light of long subsequent experience, to have been surprisingly well founded.

On September 16, 1895, the Society was called in special session to take appropriate action upon the death of Dr. C. V. Riley, who had expired two days previously.[1]

Dr. Howard was chairman of the committee appointed to prepare resolutions on Riley's death, and these appear as part of the proceedings of that meeting. In the obituary article accompanying these resolutions, among other interesting facts about Riley the following occurs: "One of Riley's cherished plans and one which he constantly kept in mind, was to publish a second and revised edition of the Missouri Reports. For this purpose he had collected a large amount of additional notes upon insects treated in the report. These notes were written in the interleaved bound copies which he always kept in his revolving bookcase close at hand. These volumes, much worn by constant use, constitute perhaps the most valuable literary legacy which he left, and it is to be hoped that at some future time his plan of republication will be realized." Unfortunately the present location of this interesting material is unknown but it may be in Mrs. Riley's possession. A number of Dr. Riley's scrapbooks are on deposit in the library of the Division of

[1] It should be noted that although this date is given in Dr. Howard's "History of Applied Entomology," p. 53, as September 19, the Proceedings of the Society show that it actually occurred on the 14th of that month.

Insects at the National Museum, but Mr. Muesebeck was unable to find in them any reference to the material previously referred to, and Dr. Howard states that the location of it is unknown to him.

In the minutes of the meeting of November 7, 1895, there appears this terse statement: "Mr. Howard read a paper entitled, 'Notes on the Life History of Culex Pungens.'" This was not published in the Proceedings but nevertheless it marked an epoch in the science of Culicidology as it initiated a series of studies of the mosquitoes for which Dr. Howard became famous. In his introductory remarks Dr. Howard says, "We are accustomed to think and speak of the mosquito as if there were but one species, yet to our knowledge, there are no less than eight species, for example, which are more or less common in the District of Columbia, and the writer has noted at New Orleans, La., certainly four different species at the same season of the year, while at Christmas time, a fifth species, smaller than the others, causes considerable trouble in the houses of that city."

This paper afterwards was incorporated in Bulletin 4 (New Series) of the Department, and in this Howard included a statement on the mosquitoes of the country at large with a list of the species of the United States then known to him. This numbers but 20 species, and among those collected in the District of Columbia are both *Anopheles punctipennis* and *A. quadrimaculatus*. The manuscript of this bulletin was transmitted to the Secretary of Agriculture on July 7, 1896, or two years before the famous discovery by Sir Ronald Ross of the rôle played by mosquitoes in the transmission of malaria.

That this discovery, together with that of the yellow fever mosquito by Reed *et al.* in 1900, enormously stimulated the systematic studies of the mosquitoes is shown by Dyar's monograph on "The Mosquitoes of the United States," published in 1922, and which lists no less than 129 species for this country alone.

However, not all of the discussions before the Society in those historic days were of momentous importance. For instance, among the many amusing miscellaneous notes given at the January meeting, 1896, is the following: "Mr. Howard exhibited a specimen of *Attacus jurulla* Westwood, and stated that the cocoon had been received from an apothecary in Monterey, Mexico, with the statement that natives hung them about their necks to prevent growth of beard." No enthusiasm apparently was evoked among those present for this kind of depilatory.

In 1897, Dr. Howard resumed his series of publications on the Micro-Hymenoptera with an article on "Some Parasites of the Coccidae with Descriptions of Two New Genera of Aphel-

ininae," presented at the meeting of March 18, in which he announced his discovery of the male of *Arrhenophagus chionaspidis* Auriv. in material reared by Koebele.

Perhaps no more astounding known example of the hardihood of insects and their ability to exist under what would appear as impossible conditions, was brought to light in a paper read by Howard at the meeting of November 3, 1898, and afterward published in the Scientific American. This dealt with the larva of the ephydrid fly subsequently described by Coquillett as *Psilopa petrolei* and which was found living in crude petroleum in California.

The Society lost by death for the third time within 5 years one of its Presidents and an outstanding figure in entomology in the person of Henry G. Hubbard. He died on January 8, 1899, and Howard served on the committee that prepared the obituary, although this bears the unmistakable imprint of Schwarz's pen.

At the turn of the 20th century Dr. Howard relinquished the office of Recording Secretary and appears only rarely in the pages of the Proceedings for a period of years. He has said in conversation that, as he had now become Chief of the organization which was to become, in 1906, the Federal Bureau of Entomology, he gained the feeling (which we who know him well are certain was mistaken) that his presence at the meetings repressed the freedom of expression that had previously prevailed, and he voluntarily absented himself from them. Fortunately this false impression finally became dissipated, and he redeemed his error by the presentation on the evening of February 11, 1909, of his delightful review of 25 years entitled "The Entomological Society of Washington."

In the course of this review Howard quotes at length from the retiring address of C. V. Riley,[2] who expressed his disapproval of the discussion of official work in the meetings of this Society, as follows: "The members of the Division have naturally become members of the Society and form a good basis for its existence; yet it would be manifestly unnecessary, if not improper, for the members of the force to band together in private simply for the discussion of those entomological subjects which they are working with me to further in official capacities. It was to get away from official surroundings—away from the work of the U. S. entomologists—that the members of the Division decided to join in the organization of this Society." Dr. Howard then records his emphatic dissent from this remarkable opinion in the following: "It is a mistake to believe that we should not talk over our official work at our Society meetings. Let us talk it over among ourselves as much as

[2] Proc. Ent. Soc. Wash., Vol. I, p. 24.

possible, in season and out of season. Where we can get the greatest number of entomologists together is the best place to talk it over." Where is there in the literature of entomology a better illustration of the fundamental difference in the psychologies of Riley and Howard than in the opposite views here expressed? In the next sentence Howard alludes to a problem that has become more acute with the passage of years, viz: "When it comes to publication, that is another matter. Results obtained by official labors should be published by official sources, provided they are appropriate to such publications." There is little need to stress to the members of the Society the obvious propriety and importance of this opinion. It is, however, a sad reflection on it, to view the unsatisfactory condition presented at present by the difficulties encountered in the publication of large, important revisionary taxonomic, morphologic, and faunistic works on entomology that has existed in official and other channels for the past 10 years or more. This condition is not by any means restricted to the larger works. What, for instance, would the taxonomic workers of the Bureau of Entomology and Plant Quarantine do for a place of immediate publication for short papers describing the species new to science, and often of first economic importance, with which they are officially working if the Proceedings of this Society were closed to such publications? It seems doubtful whether the service rendered in this way by the Society to the Federal Department of Agriculture is fully appreciated. The backbone and sinew of this Society is now, and has been for more than 50 years, supplied by the personnel of Government Bureaus. The members not only support the Society and supply it with manuscripts, but many of them are obliged by force of circumstances to purchase reprints of these reports of their official work, to be distributed largely for official purposes. This is manifestly unjust, and it is hoped that something may be done to relieve this situation.[3]

The older members of the Society will appreciate Dr. Howard's following comment: "One unique feature of the Society that has developed during recent years, has been the broadening of certain of its discussions beyond the confines of strictly entomological science. Fernow, Gill, Waite, Stiles, Holm, Vaughn, Sudworth, Pollard, E. L. Morris, Cook, and other botanists and zoologist and even paleontologists have joined us, realizing both that entomology is an enormous science and that the Entomological Society is in many ways the livest scientific society in Washington." Although our Society still

[3] This is not to be construed as in any way reflecting upon the administration of the Bureau, as it is an anachronism due to the lag between the rapid development of research in Government Departments and provision for publication of results of research.

gives abundant proof of its vitality, the recent tendency of such men, of broader interest and of special training in other branches of natural science, has been to affiliate with the Biological Society of Washington, the Helminthological Society, and other groups more closely allied with their special scientific interests. This, regrettable as it is, was an inevitable concomitant of the rapid growth of the natural sciences in America.

Toward the close of his address Dr. Howard makes the following statement: "While I was writing these words this morning, the door of my office opened, and in came old Professor Cyrus Thomas, 84 years of age, but mentally as active as ever. He came to suggest the idea that certain non-migratory locusts, after a succession of dry seasons, grow longer wings and become migratory." This was early in 1909, but the theory of phases in the locusts is usually attributed to Uvarov, who did not publish on the subject until 1921, or 12 years after this incident, and the whole idea is apparently being considered as of comparatively recent origin.

As one browses through the Proceedings of 1909–1910, it becomes apparent that the details of the informal discussions before the Society begin to shrink and to disappear from publication, and the loss of this matter can not fail to evoke a sigh of regret from the reader. That such discussions continued to maintain a very high degree of both human and scientific interest is undeniable but this loss is irretrievable.

In May, 1909, Dr. Howard paid a hasty visit to Russia, which he summarized briefly at the October meeting following. He records in this the locations of collections of material made by various Russian entomologists. In view of the subsequent changes in personnel and government and the confusion caused by the world war, these statements are of historic value and may serve future systematists as a clue to the possible location of type material.

At the meeting of November 3, 1910, Dr. Howard related experiences on recent trips to Italy and California. During the latter trip he witnessed one of the early attempts to utilize the native coccinellid *Hippodamia convergens* by collecting enormous numbers, in this case nearly 6,000,000 individuals, from caches in the Coast Range Mountains for release in the irrigated valleys. This scheme, as is now well known, proved futile and, thanks largely to the courageous opposition of Dr. Harry S. Smith, has been abandoned.

Among the many tasks undertaken for this Society by Dr. Howard has been the writing of obituary articles of many of its prominent departed members. Among the best of these is that of Francis Marion Webster in 1916.[4] Although in this

[4] Vol. XVIII, p. 79, 1916.

DR. L. O. HOWARD, 1898.

case the close association of the two men over a period of many years afforded Howard an accurate knowledge of Webster's personal traits, it is abundantly apparent from all of Dr. Howard's similar writings, that he is a keen student of character and that he delights as greatly in the study of men as of insects.

Of considerable scientific interest is the note on the powers of flight of the migratory locust *Schistocerca tartarica* published by Dr. Howard in the Proceedings in 1917[5] which records the alighting, aboard the Norwegian bark Robert Scrafton, on October 7, 1916, of a flight of this locust in latitude 20° 57′ N., longitude 39° 28′ W., or 1200 nautical miles (1218 statute miles) from the African coast. This locust inhabits Europe, Africa, Ceylon, and central and northern South America.

The nomination of Dr. Howard to be president of the Society for the year 1923 was made by President A. B. Gahan at the December meeting of 1922, who thereby relinquished his own claim to a second term in that office. Mr. Gahan pointed out that Dr. Howard was a charter member and that, in addition to having served as President in 1886–1887, he had been continuously a member of the Executive Committee of the Society from its founding until 1915. Mr. Gahan proposed that the Society honor both itself and Dr. Howard by recalling him to the chair, and this was done amid the spontaneous applause of the gathering. Upon his retirement from this office Dr. Howard, in February, 1924,[6] continued his series of historical papers on the Society with a comparison of our Society with the entomological societies of the world. He said that it was the "sixteenth oldest entomological society in the world, of those which have been publishing continuously since their formation." He lists 30 publishing societies and draws interesting comparisons, among which is the statement that our society has "a far larger body of professional entomologists among our members than has any other society." Of course, Dr. Howard does not include in this claim the large general American Societies such as the American Association of Economic Entomologists.

Dr. Howard then proceeded with his main address of the evening entitled "Insect Parasites of Insects," in which was stressed the extreme complexity of the problems presented in any attempt at the mass introduction of insect parasites from foreign sources. This is one of the most extensive and complete papers ever published by Dr. Howard in the Proceedings and contains the finest exposition of the subject that had as yet appeared in the literature.

Upon the death of that Nestor of our Society, Eugene

[5] Vol. XIX, p. 77, 1917.

[6] Vol. 26, p. 26.

Amandas Schwarz, on October 15, 1928, Dr. Howard again served the Society as the Chairman of the committee that prepared the memorial resolutions and the obituary tribute.[7] Only he could have placed on record the intimate and vital facts concerning Dr. Schwarz's early association with Riley and his services as a Federal entomologist, and this, of course, is done in Howard's inimitable way. Dr. Schwarz had been Honorary President of the Society beginning in 1917, and Dr. Howard was elected to succeed him in December, 1928.

On the fiftieth anniversary of founding of the Society, Dr. Howard relates[8] "More About the Beginnings of the Society," in which he says, "In a way, I have constituted myself the historian of the Society"; and how admirably he has accomplished this is abundantly apparent in the pages of these Proceedings. This indispensible historical material has formed the basis for a complete account of the "Officers of Our Society for Fifty Years" by J. S. Wade[9] that will become more valuable with the passage of the years.

In a birthday greeting to Dr. E. A. Schwarz, on the occasion of his eightieth birthday (April number of 1924), there is repeated a statement first published by Dr. Howard in 1909,[10] viz: "Years ago, B. Pickman Mann once said to me, 'The principal reason for the existence of the Entomological Society is E. A. Schwarz. Is it not true? What an indifferent meeting it would be without him.' "

Without detracting one iota from the glory of Dr. Schwarz's enormous value to the Society, it will immediately occur to all who know him that this statement does serious injustice to Dr. Howard's own value to the Society.

Although in the foregoing pages there are related a number of the more apparent personal services and contributions to this Society from his facile and able pen, these items do not begin to signify his value to it. Not only has he fostered our interests constantly in his official Governmental capacity, but we older members carry vivid memories of countless instances of his unrecorded contributions, discussions, and most valuable suggestions. His ready wit and delicate humor, and above all, his kindly tact, which innumerable times has bridged an awkward or embarassing contingency all have added to our meetings a quality that will remain forever among its most cherished traditions.

Signed, W. R. Walton,
F. C. Bishopp.

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[7] Vol. 30, p. 153.

[8] Vol. 36, p. 51.

[9] Vol. 38, p. 99–145, June 1936.

[10] Vol. 26, No. 4 (inside back cover page).

A NEW SPECIES OF IXODES FROM MASSACHUSETTS.

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During June and August, 1936, in the course of a study of *Dermacentor variabilis* in Massachusetts, a number of small rodents were collected and examined for external parasites. On the first of these two surveys the authors were accompanied by A. H. Howell of the Bureau of Biological Survey, U. S. Department of Agriculture. Mr. Howell identified all of the hosts collected. In addition to larvae and nymphs of *D. variabilis*, the collections included several specimens of a species of *Ixodes* which proved to be undescribed.

This *Ixodes* was collected in all stages and both sexes of adults. It was taken on the jumping mouse (*Zapus hudsonius hudsonius*), the meadow mouse (*Microtus pennsylvanicus pennsylvanicus*), the white-footed mouse (*Peromyscus leucopus fusus*), the Norway rat (*Rattus norvegicus*), and the short-tailed shrew (*Blarina brevicauda aloga*). Specimens were collected in several localities on the islands of Martha's Vineyard and Nantucket, and at West Falmouth on Cape Cod, Mass. Specimens of this species from *Microtus p. pennsylvanicus* and from the muskrat (*Ondatra z. zibethica*), collected on Cape Cod, were found in the Boston Museum of Natural History collection by Dr. J. Bequaert, who thought they belonged to an undescribed species, and gave us an opportunity to examine them.

During the survey in June examinations were made on 15 white-footed mice, 3 jumping mice, 83 meadow mice, and 2 rats. On these 103 rodents were found 1 larva, 25 nymphs in all stages of engorgement, 1 male and 24 females of the new species of *Ixodes*, together with 240 larvae and 169 nymphs of *Dermacentor variabilis*. Several rabbits examined at the same time were infested with specimens of *Ixodes dentatus* but by none of the new species. Late in August and early in September examinations of 49 meadow mice, 7 white-footed mice, 1 rat, and 1 short-tailed shrew on Martha's Vineyard and Nantucket produced 9 larvae and 2 females of the new species.

Ixodes muris, n. sp.

Female (Plate 11, *A* and *B*).—Capitulum, length 730 μ (from tip of hypostome to line drawn between tips of posterior lateral angles of basis capituli); basis capituli, width 390 μ, dark reddish brown, posterior margin nearly straight, posterior lateral angles prominent, moderately sharp, slight ridge bounding porose area externally and extending forward between porose area and base of palpus; ventrally with broad rather blunt auriculae projecting latero-posteriorly from behind base of palpi. Porose areas superficial, ovoid, narrowed

externally, almost reaching posterior margin of basis capituli, lateral dimension 135 μ, interval 70 μ (about equal to antero-posterior dimension); palpi rather long and slender (length 500 μ); article II distinctly longer (250 μ) than article III (220 μ). Article I slightly prominent ventrally; hypostome acuminate, tapering from apical third to a sharp point. Three rows of teeth on each side, 2 toward base. Outer rows with about 15 teeth per row; inner row with about 10; becoming minute at tip. Chelicerae with internal digit slender, with small tooth at apex, external digit with 5 teeth, the basal heavy, diminishing to the tip. Dorsal process with 2 short teeth.

Scutum, length 1.15 mm., width 0.9 mm., dark reddish brown, yellowish toward anterior end, broadest slightly before middle, broadly and evenly rounded

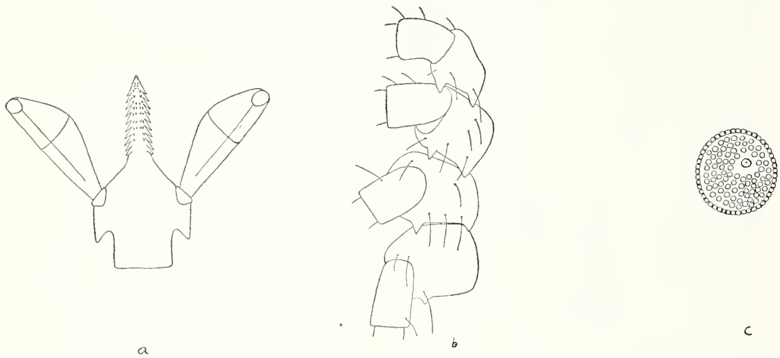


Figure 1.—*Ixodes muris* n. sp. a. Ventral view of capitulum of nymph. b. Coxae of nymph. c. Stigmal plate of nymph. Drawn by H. B. Bradford.

posteriorly, cervical angles short, rather sharp, cervical grooves shallow, widely divergent posteriorly, lateral carinae distinct, following marginal contour to edge of scutum near its posterior third, surface glabrous with sparse small punctures and scattered short yellowish hairs.

Legs dark reddish brown, rather slender, all tarsi tapered at tip, especially I and IV. Tarsus I about twice (510 μ) as long as metatarsus I (250 μ). Coxae contiguous, bearing several pale hairs; coxa I with a moderately long, stout, internal and a shorter, sharp, external spine, the latter as broad as long; coxa II with external spine similar to that on coxa I and a sharp internal angle; coxa III with external spine more blunt than preceding and a sharp internal angle; coxa IV with a short, rounded, external spine.

Stigmal plates very large (320 by 350 μ), broadly oval, 3 to 8 rows of goblets, not counting margin, totalling about 150. Macula nearly circular, antero-ventrally from center. In some specimens stigmal plates with 2 rows of goblets at narrowest and 6 rows at widest point.

Body light brown, finely striate and minutely punctate, with sparse, short, pale hairs, oval, broadest slightly behind middle. Marginal groove deep, extending from shield around posterior margin.

Vulva between coxae IV; genital groove subparallel anteriorly, divergent posteriorly, extending nearly to margin; anal groove rounded in front, sides diverging.

Ten other females, 3 from the type lot and 7 collected at the same time in the same region, showed the following variations: Length of capitulum, minimum 604 μ, maximum 730 μ, average 688 μ; width of the basis capituli, minimum 350 μ, maximum 409 μ, average 368 μ; lateral dimension of porose areas, minimum 100 μ, maximum 130 μ, average 117 μ; interval between porose areas, minimum 50 μ, maximum 111 μ, average, 83 μ, the interval in each individual smaller than the porose area; length of palpi, minimum 430 μ, maximum 560 μ, average 513 μ; length of article II, minimum 220 μ, maximum 290 μ, average 257 μ; length of article III, minimum 200 μ, maximum 255 μ, average 218 μ, article III being shorter than article II in each individual; length of scutum, minimum 990 μ, maximum 1174 μ, average 1092 μ; width of scutum, minimum 740 μ, maximum 967 μ, average 811 μ; length of tarsus I, minimum 470 μ, maximum 546 μ, average 506 μ; length of metatarsus I, minimum 230 μ, maximum 293 μ, average 263 μ. The auriculae on some females are more slender than in the type from which the drawing was made.

Male (Plate 11, *C* and *D*).—Capitulum length 420 μ (from tip of palpi to line connecting tips of postero-lateral angles of basis capituli). Basis capituli dark reddish brown, greatest width (250 μ) behind base of palpi, distinctly narrowed posteriorly. Posterior margin straight, no cornua but angles sharp, ventrally with small tooth near base of palpi. Hypostome with tip slightly notched, armed on each side with 7 rows of serrate plates, each with about 5 cusps, the basal plate prominent. Palpi rather stout, 300 μ long, article II 150 μ long, article III 130 μ long; bearing a number of moderately long hairs.

Scutum, length 1.6 mm., width 0.9 mm., reddish brown, pseudoscutum distinguishable, slightly more convex than rest of scutum, evenly and finely punctate, with sparse, short, pale hairs. Cervical grooves faint, converging and then widely diverging, cervical angles rounded.

Legs dark reddish brown, all tapering to tip. Tarsus I 450 μ long, metatarsus 230 μ long.

Coxae rather close together but not contiguous; coxa I with a short but acute internal spine (about 50 μ long) and an external spine about one-half as long; coxa II with internal angle prominent and a short, sharp, external spine slightly larger than on coxa I; coxa III with small internal spine, the external spine slightly broader than on coxa II; coxa IV with internal angle slightly prominent, external spine broader than that on coxa III.

Stigmal plates large, nearly circular, about 280 by 300 μ in diameter. Macula oval, small (about 50 μ), located antero-ventrally from center. Goblets minute, about 4 rows at narrowest and 10 at widest points between macula and marginal cells.

Body: Marginal fold yellow, finely punctate, with scattered, short, pale hairs, moderately wide, well defined by the deep marginal groove which reaches margin at anterior sixth; venter yellow to reddish brown, with scattered, rather long, pale hairs. Plates highly sclerotized, shiny, with scattered fine punctures, fewer and smaller posteriorly; pregenital plate ogival, reaching forward to posterior tip of coxa I, median plate 750 μ long, 210 μ wide at anterior end,

and 525 μ wide at posterior end, adanal plates subrectangular, 210 μ wide at anterior end, about 100 μ wide at posterior end, length about 425 μ; anus nearly round, about 90 μ in diameter; anal groove straight (transverse) in front of anus, divergent, then curving inward at posterior margin.

Nymph (Fig. 1 and Plate 11, *E*).—The nymph is similar to the female, reddish brown with fuscous cast.

Capitulum, length 310 to 340 μ; basis capituli, width 180 to 210 μ, subtriangular; cornua strong, sharp, projecting postero-laterally; palpi, length 260 to 280 μ, article II 120 to 130 μ, article III 110 to 120 μ; auriculae strong, as in female; hypostome with 2 rows of teeth on each side at base, 3 rows beyond middle, outer row with about 10 large teeth, next row with 8, basal tooth in each row blunt, inner row with 5 teeth, tip with a number of small scale-like teeth; chelicerae as in female.

Scutum somewhat broader at apex and broader in relation to length than in female, length from 570 to 600 μ, width 480 to 500 μ, cervical grooves as in female, lateral carinae slightly shorter and less prominent than in female, scattered punctures and short hairs.

Legs similar to those of female except that the internal spines are shorter on coxae I, longer on II and III, external spine on coxa I relatively longer than in female, external spine on coxae II to IV diminishing slightly in size. Tarsus I 300 to 310 μ, metatarsus I 110 to 130 μ in length.

Stigmal plates about 140 by 160 μ, 2 or 3 rows of goblets at narrowest and 5 or 6 rows at widest place between macula and marginal cells.

Body yellowish brown with scattered short hair on dorsum and more and longer hairs ventrally; marginal fold moderate, extending around posterior margin, where it is narrowed, anal and genital grooves as in female.

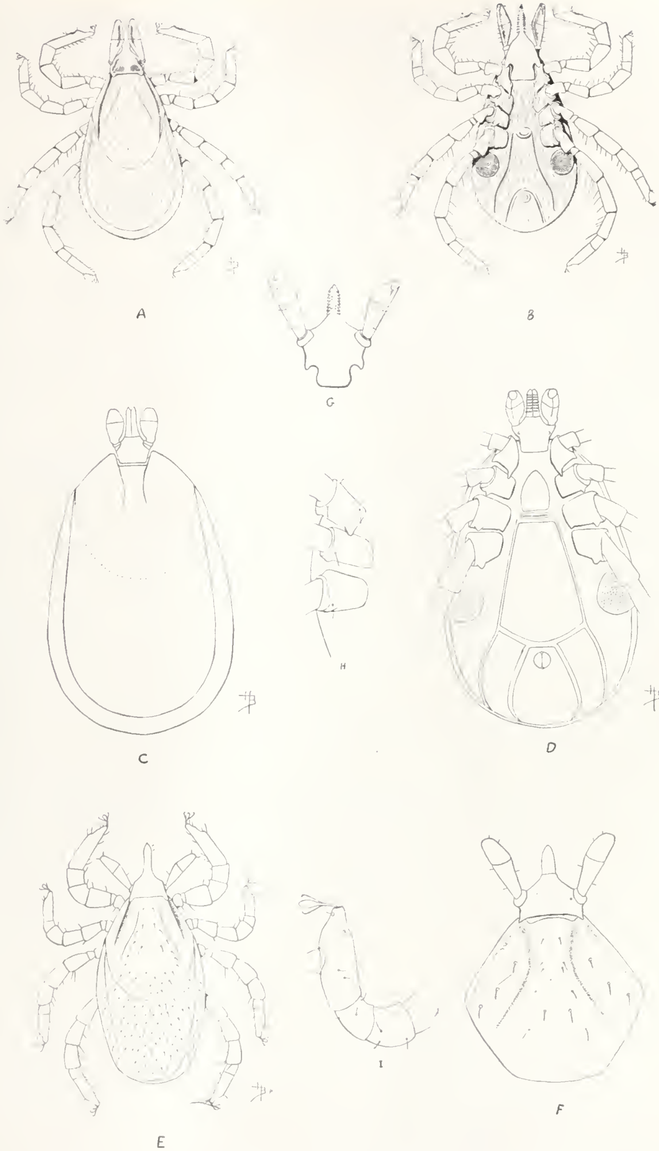
Larva (Plate 11, *F*, *G*, *H* and *I*).—Capitulum, length 180 μ, basis capituli 140 μ wide, yellowish brown with slight fuscous appearance, shape similar to that in female, cornua distinct but not prominent; palpi 130 μ long, 50 μ broad, article II not markedly tapered at base, article III broadly rounded at tip; auriculae as in nymph, hypostome more robust than in nymph; with 2 rows of teeth on each side, near the tip 3 rows, outer row with 7 large teeth, next row with 6, small scale-like teeth at tip.

Scutum reticulated, with a few scattered punctures, about 10 on each side, yellowish-fuscous brown, 310 μ long, 340 μ wide, similar in shape to that of nymph, but broader in proportion to length, scapular angles less acute than in female, cervical grooves distinct, widely diverging and almost reaching the posterior margin, lateral carinae reaching margin at lateral angles of scutum.

Legs very stout, yellowish brown. Tarsus I 180 μ long, metatarsus I 70 μ long, tarsi tapered as in nymph. Coxa I with a distinct internal and external triangular spine, the former twice the length of the latter; coxa II with a slight, broad, external spine; coxa III with a slight external ridge.

Body broadly oval, yellowish brown, striate, with scattered pale hairs, anal groove as in nymph.

Type.—No. 1253, U. S. National Museum, holotype female, allotype male, 10 paratype females and 5 nymphs from Bishopp Accession No. 23477, June 13, 1936, Nantucket, Mass., on



Ixodes muris n. sp. A. Dorsal view of female. B. Ventral view of female. C. Dorsal view of male. D. Ventral view of male. E. Dorsal view of nymph. F. Scutum and capitulum, dorsal, of larva. G. Ventral view of capitulum of larva. H. Coxae of larva. I. First tarsus of larva. Drawn by H. B. Bradford.

meadow mouse. Nymph described from above lot, and larva from lot taken on meadow mouse, August 29, 1936, Menemsha, Martha's Vineyard, Mass., Bishopp Accession No. 26440. Other paratypes as follows: 7 females and 2 nymphs from Bishopp Accession No. 23461, from meadow mouse, June 10, 1936, Edgartown, Martha's Vineyard, Mass.; 2 females and 2 larvae from meadow mouse, August 31, 1936, Nantucket, Mass., Bishopp Accession No. 26449; 2 larvae from Norway rat, August 30, 1936, Edgartown, Martha's Vineyard, Mass., Bishopp Accession No. 26447. The above material was collected by the authors. One female from meadow mouse, Barnstable, Mass.; 1 female from meadow mouse, Sept. 9, 1933, Wellfleet, Mass., Donald Griffin, Coll.; 1 female from muskrat, Barnstable, Mass. The last 3 lots deposited at the Boston Museum of Natural History and at the Museum of Comparative Zoology.

This species appears to be most closely related to *Ixodes minor*, which is recorded from *Hesperomys* sp. ? (Muridae) in Guatemala. The female differs from *Ixodes minor* in having a very large stigmal plate, smaller cornua on the basis capituli, and porose areas ovoid rather than round and separated by much less than their lateral dimension. The anal groove is rounded in *I. muris*, while in *I. minor* it is ogival. The cervical grooves and lateral carinae are more prominent. The male of *I. muris* differs from that of *I. minor* in having the tip of the hypostome notched, the anal plate longer in proportion to its width, and the spurs on coxae II, III, and IV external rather than in the center or internal. The basis capituli in *I. muris* has no cornua, while in *I. minor* the cornua are very prominent.

Ixodes muris falls in the group of *Ixodes* with tarsus I more than 1½ times as long as metatarsus I. The female differs from *I. ricinus scapularis* in having large auriculae on the ventral surface of the basis capituli and a shorter internal spine on coxa I. The male has fewer punctures, longer anal and adanal plates, and a shorter internal spine on coxa I. The female differs in many respects from that of *I. diversifossus:* the auriculae are stouter and do not project ventrally and article I of the palpus does not bear a spur. The male has larger stigmal plates, smaller punctures, and longer anal and adanal plates than in *I. diversifossus*, and is devoid of cornua on the basis capituli. The female differs from that of *I. dentatus* in having hypostome dentition 2 | 2 to 3 | 3, the scutum distinctly longer than broad, larger stigmal plates, and the porose areas large and close together.

A NEW WEST INDIAN SPECIES OF MIRAX HALIDAY PARASITIC ON THE COFFEE LEAF-MINER (HYMENOPTERA : BRACONIDAE).

By C. F. W. Muesebeck,
Bureau of Entomology and Plant Quarantine.

Studies in the microgasterine genus *Mirax* have been difficult because of the paucity of available specimens. In connection with the preparation of my synopsis of the North American species[1] I had before me not more than twenty-five specimens of the genus, and of the six species recognized three were represented by only the unique types. Those species of which the habits are known are parasites of lepidopterous leaf-miners or bast-miners; but there has been no suggestion in the literature that any species might be considered of economic significance. It was with some amazement, therefore, that I recently received for identification from Mr. Francisco Sein, Jr., of the Agricultural Experiment Station of the University of Puerto Rico, fifty specimens of a new species of *Mirax* which had been reared from the coffee leaf-miner, *Leucoptera coffeella* Guér., on the island of Guadeloupe. I had not previously seen so many specimens of the entire genus. Subsequently an additional series of thirty-five specimens were received from Dominica, all likewise reared by Mr. Sein from *L. coffeella*. Observations have indicated that the species may be of definite value as a control agent of that coffee pest.

Very recently D. S. Wilkinson[2] described *Mirax leucopterae*, which was reared from a closely related species of *Leucoptera* at Bukola, Tanganyika, and suggested that *L. coffeella*, which also occurs there, is probably likewise attacked by the same parasite. The species reared by Mr. Sein in the West Indies is a quite distinct form, however, as was immediately apparent on the comparison with paratypes of *M. leucopterae* very kindly sent me by Mr. Wilkinson. It appears to be the first species of *Mirax* recorded from the West Indies.

Mirax insularis, new species.

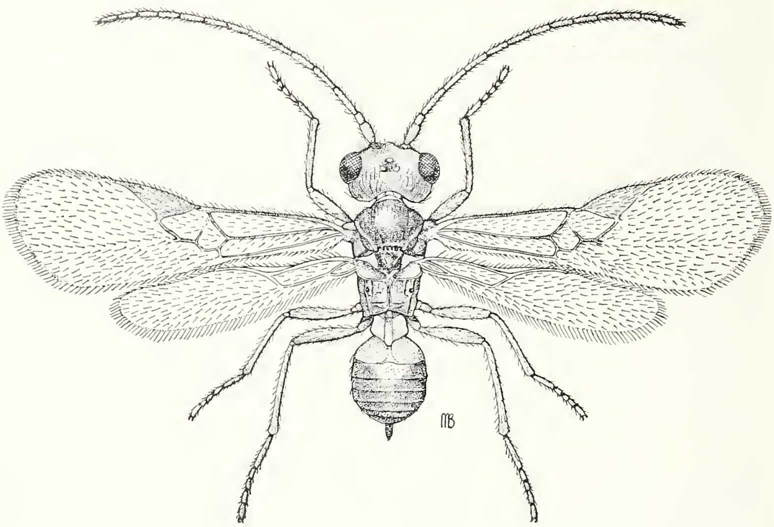
Immediately distinguished from *leucopterae* Wilkinson by the presence of a complete median longitudinal carina on the propodeum and a distinct scutellar sulcus. From *texana* Muesebeck, to which it appears most closely allied, it is readily separated by the less completely sculptured propodeum, the much shorter stub of the third cubital abscissa, and the mostly yellowish thorax.

Female (Fig. 1).—Length, 1.5 mm. Head slightly wider than thorax, smooth; eye large, at least as long as width of face, temple rounded; ocellocular line

[1] Proc. U. S. Nat. Mus. vol. 61, Art. 15 : 10–12, 1922.

[2] Bull. Ent. Res., vol. 27 (3) : 385, 1936.

about as long as one side of ocellar triangle; median longitudinal groove of vertex absent; antenna about as long as body, first flagellar segment conspicuously longer than second. Thorax slightly wider than high; mesoscutum, scutellum, and pleura smooth; notauli distinctly impressed on more than anterior third of mesoscutum, wholly wanting beyond; scutellar sulcus deep, minutely



Female of Mirax insularis, new species. Drawn by Mrs. Mary F. Benson.

foveolate; propodeum with a complete median longitudinal carina and a few irregular transverse rugae either side of this; lateral margin of propodeum sharply carinate; first cubital and first discoidal cells not completely separated, the first abscissa of cubitus being more or less obliterated basally; stub of third abscissa of cubitus less than half as long as second abscissa. Abdomen about as long as thorax, smooth and shining; sclerotized plate of first tergite very narrow; plate of second tergite reduced to a very narrow longitudinal strip on basal half, strongly widened apically; ovipositor sheath shorter than posterior metatarsus.

Yellow or brownish-yellow varied with dark brown or piceous; head entirely yellow; mesoscutum and scutellum dark brown; venter of abdomen and first and second tergites pale yellow; third and fourth tergites laterally, and the following entirely, piceous; antennae brownish, a little paler basally; legs pale yellow; wings hyaline, stigma and veins light brown.

Male.—Agrees with the female in essential characters. The antennae are a little more slender and somewhat paler, and the abdomen is narrower, than in the female.

Type locality.—Guadeloupe, West Indies.
Type.—U. S. N. M. No. 52019.
Host.—*Leucoptera coffeella* Guér.

Described from 33 females and 17 males (including female type and male allotype) reared from *L. coffeella* by Francisco Sein in July, 1936, on Guadeloupe; and 22 females and 13 males reared by Mr. Sein from the same host, December 7, 1936, on Dominica. Paratypes are deposited in the British Museum and in the University of Puerto Rico.

TRAP-LIGHT STUDIES ON LEAFHOPPERS BELONGING TO THE GENUS EMPOASCA (HOMOPTERA : CICADELLIDAE), WITH THE DESCRIPTION OF TWO NEW SPECIES.[1]

By Nancy H. Wheeler,
Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

INTRODUCTION.

Much has been written in regard to the response of insects to light, whether they are positively or negatively phototropic, and their reaction to lights of different colors and intensities, correlated with the influence of temperature, wind, and various other environmental factors. Many have experimented with the use of trap-lights for attracting insects under these varying conditions. With some species trap-lights seem of importance in ascertaining occurrence and abundance, while with others they appear to have little value. Upon occasion, species which might otherwise be considered rare in a given locality may be procured more readily in this way, possibly by attraction to light or because of nocturnal habits or apparent inactivity during the day. Also, by this means, species new to science have been discovered (*7, 9*). The general impression, however, seems to be that trap-lights are not of much practical value in the control of insects, although references in the literature to their use, both for exploration of fauna and in insect control, are becoming more frequent (*6*). The data presented in this paper show that the use of trap-lights in connection with a practical research problem may be of considerable value, especially when correlated with data obtained in other ways.

Two trap-lights were operated over a period of 4 years, 1932–1935, inclusive, at the Arlington Experiment Farm, Arlington, Va., for the purpose of collecting species of leafhoppers belonging to the genus *Empoasca*. The data presented

[1] The writer is greatly indebted to Dr. F. W. Poos, under whose direction this work has been done, and to Mr. P. W. Oman for suggestions and criticisms in the preparation of this paper.

in this paper include the records obtained in the course of these studies on each species, as follows: First and last seasonal appearances, relative abundance, and proportion of sexes. Notes on five new species, with descriptions of two, and some new synonymy are included. The data obtained on the seasonal occurrence of *Empoasca fabae*, the potato leafhopper, an insect of much economic importance, are emphasized, including a discussion of the significance of these data in determining the period of northward migration of this species.

EQUIPMENT AND METHODS.

The trap-light used at Arlington was constructed so as to combine the features best adapted for the attraction of smaller insects, such as leafhoppers, with a minimum of loss and damage to them. The apparatus herein described and illustrated (Fig. 1) consists of the following main parts: A metal roof or reflector, a metal funnel, and a glass cyanide jar. The principal measurements of the trap illustrated are as follows: Reflector 30 inches in diameter; funnel 12 inches in diameter and 10 inches in depth; Mason glass jar, 1-quart size, with screw top.

The reflector is made of a fitted circular piece of sheet metal, into the center of which the socket for the electric light bulb is inserted. Midway from the center and equidistant from each other are soldered three large metal hooks, from each of which is suspended a metal chain, about 15 inches long, from which the funnel, with attached jar, is supported at the desired distance from the electric light bulb.

The size and type of electric light bulb are optional. Several different kinds of bulbs were used in these trap-light experiments: 500-watt daylight clear, 500-watt ivory, 200-watt ivory, 200-watt daylight inside frost, and 200-watt daylight blue. While no accurate means was afforded for comparing the effectiveness of these different kinds of bulbs for attracting *Empoasca*, the 200-watt daylight blue bulb seemed to be as effective as any of the other kinds, if not more so, and was therefore used most of the time.

The funnel is made of galvanized iron and is attached to the metal chains, at a distance of about 8 inches from the reflector, by three metal hooks inserted, at equal distances, through its rim. The electric light bulb and top of the funnel are surrounded by ¼-inch mesh screen wire to prevent the larger insects, especially unwanted Lepidoptera, from entering the funnel. The screw-top of the jar is firmly soldered to the neck of the funnel.

The detachable glass jar serves as the receptacle into which the insects fall and are killed. In it is a preparation of plaster of

paris and cyanide, covered with several layers of blotting paper from which the insects are readily removed.

The whole trap is supported by a stand made of iron pipe—one upright piece, placed firmly in the ground, and an adjustable cross piece from which the light is suspended and through which the electric light cord is run to the socket.

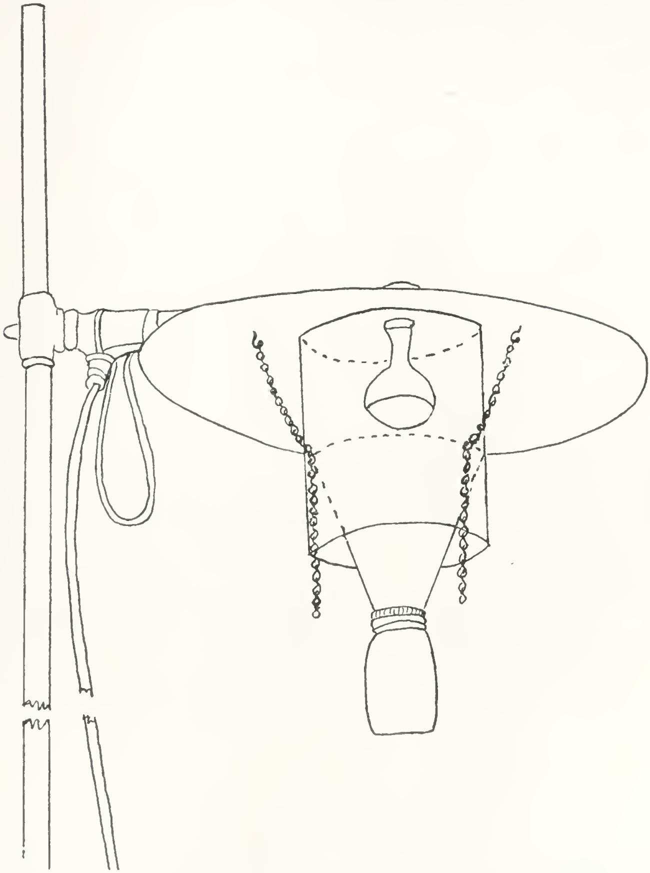


Figure 1.—Trap-light used at Arlington Experiment Farm; *b*, electric bulb; *f*, funnel; *j*, glass jar; *r*, reflector; *s*, screen wire.

The trap-lights were erected in two different locations on the Arlington Experiment Farm and, for convenience, designated A and B. The former was placed so that it would draw largely from the upland territory, mainly from grass, orchard, trees, and shrubs. The latter was located on bottomland, bordering woods on one side and a 65-acre field containing various crops

on its other side. During 1935 no potatoes were grown on the farm, but the field previously mentioned was devoted largely to corn and soybeans, with a variety of other crops such as sugar beets, Jerusalem artichokes, cantaloupes, tomatoes, peanuts, rhubarb, asparagus, and eggplant.

Each season the trap-lights were placed in operation as soon as favorable weather conditions prevailed, the earliest date being April 4, 1935. Both lights continued in operation almost nightly throughout the first season, or until the collections were found to be so heavy as to make quantitative counts impractical. Consequently, in 1933, 1934, and 1935 their use was suspended during most of July and August. Operation of the lights was resumed each season during September, October, and November, the latest date of operation being December 5, 1934, 23 days after the last *Empoasca* had been caught in the traps.

The electric bulb in each light was turned on and off at regular hours, usually at dusk and at dawn. Each day the insect container was emptied and its contents sifted and sorted out. A series of metal sieves, such as are used in separating seeds of different sizes, were found to aid considerably in sorting out smaller leafhoppers from the bulk of miscellaneous material. With the aid of a camel's-hair brush the individual specimens of *Empoasca* were picked out and removed to vials temporarily. All *Empoasca* were saved, and in the smaller collections the sexes were separated under a binocular microscope and counted to determine their relative proportions. In collections totalling 100 or less, all the males were identified to species, and in the larger collections 100 males were selected at random for specific determination.

Since most of the species belonging to this genus can not be definitely differentiated by external morphological characters, a special technic, previously described (*11*), was followed to determine the various species. Preparation of this material for identification was a slow and tedious process, and the accurate determination of the less abundant species required considerable study.

COLLECTIONS OF EMPOASCA OVER 4-YEAR PERIOD.

The data obtained from collections of *Empoasca* taken in the two trap-lights during the four seasons 1932, 1933, 1934, and 1935 have been tabulated and summarized in Table 1. These figures were derived from the handling of thousands of specimens of which, as has been stated, only representative numbers were selected for determining the proportion of sexes present and the relative abundance of the various species. Of 27,971 specimens counted, 10,695 were females and 17,276 were males. Among the 11,928 males identified by means of their internal genitalia, 28 different species were represented, 3 of which are still undescribed.

The apparent preponderance of males in 1932 as compared to the more equal numbers of the sexes listed during the other years is due to the fact that in 1932 some of the larger collections (in which males greatly predominated) were counted in toto and these numbers included in the summary. In many of the other large collections only 100 male specimens were sorted out for specific identification, and the proportion of sexes in these collections was, therefore, not determined.

Table 1.—Summary of determinations of Empoasca collected in trap-lights, Arlington Experiment Farm, 1932–1935.

Item	1932		1933		1934		1935		
	Trap A	Trap B	Trap A	Trap B	Trap A	Trap B	Trap A	Trap B	*Total*
Earliest collection:	*Date*	*Date*	*Date*	*Date*	*Date*	*Date*	*Date*	*Date*	
Females	5/16[1]	6/6[1]	5/13	5/15	5/11	5/11	5/7	5/7	
Males	5/20	6/6	5/13	5/15	5/12	5/14	5/7	5/10	
Latest collection:									
Females	11/10	11/6	11/5	11/2	11/29	11/19	11/11	11/12	
Males	11/10	11/6	11/3	11/2	11/21	11/4	11/12	11/12	
Proportion of sexes:[2]	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
Females	1,341	1,261	1,356	1,554	1,589	1,055	1,413	1,126	10,695
Males	3,957	3,011	1,520	1,675	1,601	1,319	2,455	1,738	17,276
Males determined as to species:									
fabae	1,234	549	1,271	1,254	1,315	901	2,230	1,348	10,102
erigeron	77	138	42	207	98	237	115	192	1,106
pergandei	4	5	2	98	3	7	2	68	189
solana	1	7	15	11	23	59	11	15	142
sativae	1	0	30	6	29	2	0	0	68
recurvata	5	14	0	18	6	10	2	2	57
alboneura	30	1	9	1	2	0	1	1	45
bifurcata	4	2	5	5	6	10	5	5	42
birdii	0	1	0	5	12	7	3	7	35
salicis	0	10	1	15	0	2	0	5	33
atrolabes	0	1	0	25	0	3	0	1	3
obtusa	10	1	3	1	1	2	1	0	19
patula	0	3	1	0	0	1	1	7	30
dentata	0	4	0	4	1	0	0	0	9
ditata	0	2	0	2	3	0	0	1	8
chelata	0	0	1	5	0	0	1	0	7
delongi	0	0	2	4	0	0	0	0	6
maligna	0	4	0	0	0	0	0	0	4
curvata	0	0	0	0	1	1	0	0	2
incida	0	0	0	1	0	1	0	0	2
unica	0	1	1	0	0	0	0	0	2
pallida	0	1	0	0	0	0	0	0	1
smaragula	0	0	0	1	0	0	0	0	1
vergena	0	0	0	0	0	1	0	0	1
ellisae	0	0	0	0	0	0	0	1	1
Undescribed	0	0	0	1	0	0	1	1	3
Total	1,366	744	1,383	1,664	1,500	1,244	2,373	1,654	11,928

[1] In 1932, trap-light A was not operated until May 16, and B not until June 6.

[2] See discussion, page 146.

Variation in the Proportion of Sexes.

Females were seasonally among the very first specimens of *Empoasca* to be caught in the trap-lights. In four instances out of eight both sexes appeared in the first collections, and in the other four instances females were caught from 1 to 4 days earlier than males. During the first week or ten days after the first specimens were caught the trap-light collections generally remained very small, the number of females usually exceeding that of the males. Likewise, in collections made by sweeping in the field with an insect net during this same period, females were the first to be obtained and they occurred in much greater proportion than males. As the season advanced the collections gradually grew larger. As the numbers of *Empoasca* increased at the trap-lights, the proportion of males increased, until in the larger collections they far outnumbered the females. During the period of greatest abundance approximately 75 percent of the adults in the collections at the trap-lights were males, whereas this proportion of sexes was almost exactly reversed in collections made during the same period with the net in the field, 75 percent of the adults being females. During July and August trap-light collections proved heaviest, with a perceptible falling off in numbers as soon as the nights grew cooler. In the comparatively small collections made during September, October, and early November each year the number of males and females became more equal, a few individuals of each sex being taken in the last collections. The latest date for a female to be caught in the trap-light was November 29, 1934, and for a male November 21, 1934, both of those in trap A.

Number of Different Species of Empoasca Attracted.

The collections obtained from the trap-lights have shown that not only a larger quantity but a much greater variety of *Empoasca* have been obtained than with an equal amount of effort put forth in collecting by sweeping various host plants with insect nets. As has been stated, the total number of species obtained during the four seasons was 28, including 3 species still undescribed, but the greatest variety of species to be collected in one season numbered 17, taken both in 1932 and in 1933 at trap-light B. It may be noted that during all the seasons under observation a greater variety of species of *Empoasca* was obtained from trap-light B, where there was apparently a greater variety of hosts nearby from which to draw. It is significant also, that in this trap, located in the lowland, where there was probably a greater variety in host material, the total number of *Empoasca fabae* was less each year than in trap A, located in the upland.

The greatest variety of species each season was collected

during June and September, the maximum number in one collection being 10, taken September 25, 1933. Nine species were taken in one collection June 20, 1932, seven species September 26, 1934, and six species June 11, 1935.

The two species of *Empoasca* most commonly present in the trap-lights were *fabae* and *erigeron*. They occurred in the trap-lights throughout the entire season, while the species less common showed more definite seasonal appearance. The following species, in the order of their abundance, were taken in both the spring and the fall collections, although in some cases they were more abundant in the spring: *pergandei*, *alboneura*, *bifurcata*, *birdii*, *salicis*, *patula*, *ditata*, *incida*, and *unica*. The species *atrolabes*, *obtusa*, *maligna*, *curvata*, *pallida*, *smaragdula*, and *vergena* were collected only in the spring, while *solana*, *sativae*, *delongi*, *chelata*, and *ellisae* were collected only in the fall. *Empoasca recurvata* and *E. dentata* were taken both in the spring and in the fall, although more specimens of each species were found in the fall collections. Two of the undescribed species were taken in the spring and one in the fall.

As indicated by collections in the field, *Empoasca fabae* is by far the most abundant species. From the 11,928 specific determinations made from internal male genitalia, 10,102 were of *fabae*, 1,106 of *erigeron*, 189 of *pergandei*, and 142 of *solana*. The other 24 species taken in the trap-lights were represented by less than 100 specimens each, and in 7 of these species only a single male specimen was procured. By this means the following species, not previously obtained by sweeping in the field, were collected for the first time in this locality: *atrolabes*, *obtusa*, *patula*, *incida*, *chelata*, *unica*, *pallida*, *ellisae*, and three undescribed species.

These trap-lights have also yielded what appear to be the earliest records on the occurrence of some species of *Empoasca* which at the time were recognized as species new to science, but have since been described from later collections from other sources. *Empoasca chelata*, recently described by DeLong and Davidson (*5*) from two specimens, male and female, collected at Okolona, Miss., June 14, 1934, from *Crataegus*, was collected in the trap-lights at Arlington Farm for the first time September 19, 1933, six male specimens being taken during the period September 19 to October 1. Likewise, *E. ditata*, described by DeLong and Caldwell (*4*) from two male specimens collected at Cedar Swamp, Ohio, April 17 and 24, 1934, are represented in the Arlington Experiment Farm trap-light collections by eight specimens collected as early as June 21, 1932.

NEW AND UNDESCRIBED SPECIES.

The three specimens of *Empoasca* listed in the table as undescribed represent, in the writer's opinion, three distinct new

species. However, in each case neither the external characters nor the internal male genital characters are distinct enough to justify the description of a new species from a single individual, and they are, therefore, retained in *statu quo* until a larger series may be procured. Another single specimen, however, with well-defined internal male genital characters, is recognized as a species new to science and its description and that of another new species, described from a series of eleven males, follow:

Empoasca ellisae, new species.

A medium-sized species of yellowish-green color. Length about 3 mm.

External characters.—Face tinged with orange. Vertex yellowish green with touches of orange on either side of median line; broad, rounded, but not parallel margined, produced about one-third its length beyond anterior margins of the eyes, about twice as wide between eyes as length at middle. Pronotum with prominent humeral angles tinged with bluish green; about as wide as head and more than twice as long. Scutellum with an irregular pale longitudinal median band terminating near the apex in a small circular spot. Elytra long, yellowish green, with apical third hyaline.

Male internal structures (Fig. 2).—Lateral processes long, slender, and bluntly tapered in lateral view; in ventral view nearly straight, widening gradually toward tips and ending in a small, slightly curved projection on the inner margins. Dorsal spines heavy and tapering to sharp points; in lateral view long and strongly curved, first caudad, then ventrad and cephalad with their apices directed anteriorly. Styles relatively broad and long; in ventral view, inner margins more or less regular and parallel along middle third, but curved outwards at apical third, which is more heavily chitinized, with apices divergent; outer margins sinuate.

Sternal apodemes relatively short, about as broad as long, with posterior ends slightly rounded and divergent.

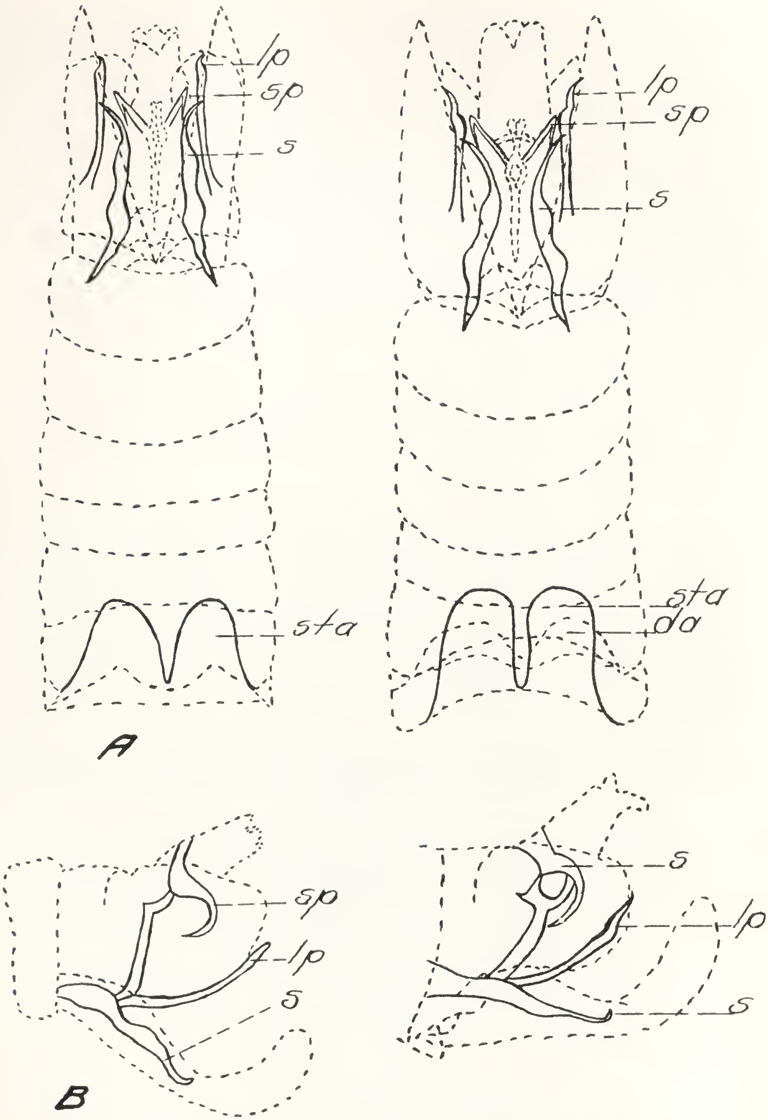
Described from one specimen taken in trap-light B, Arlington Experiment Farm, Arlington, Va., November 5, 1935.

Holotype male in United States National Museum collection (Cat. No. 52011).

Empoasca salicis, new species.

Resembles *patula* in form, but darker in color with both dorsal and sternal apodemes, the latter being very much shorter and narrower than those of *patula*. Length about 3.5 to 4 mm.

External characters.—Face greenish yellow. Vertex and upper portion of clypeus tinged with orange; vertical median area and narrow margins adjacent to eyes white. Pronotum brownish yellow with three white spots near anterior margin; humeral angles tinged with green. Scutellum with an irregular longitudinal median white stripe. Elytra long, greenish yellow in color with apices tinged with brown, hyaline; narrow black line along inner margin and extending around apices.



ellisae
Fig. 2

salicis
Fig. 3

Figure 2.—Internal structures of abdomen of male of *Empoasca ellisae*, n. sp. : *A*, ventral view; *B*, lateral view; *lp*, lateral process of pygofer; *s*, style; *sp*, dorsal spine of tenth segment, *sta*, sternal apodeme for muscular attachment.

Figure 3.—Internal structures of abdomen of male of *Empoasca salicis*, n. sp. : *A*, ventral view; *B*, lateral view; *lp*, lateral process of pygofer; *s*, style; *sp*, dorsal spine of tenth segment; *sta*, sternal apodeme for muscular attachment *ba*, dorsal apodeme.

Male internal structures (Fig. 3).—Plates in lateral view long, wide at base, narrowed toward middle, abruptly curved upward with apex rounded; heavily clothed ventrally with long spines. Lateral processes long, slender, slightly curved upward in lateral view, somewhat enlarged near apical third, then tapering and sinuate; in ventral view long, slender, with basal two-thirds comparatively straight, slightly enlarged near apex with elongated, fingerlike process curved outwardly on outer margin. Dorsal spines heavy, elongated, and tapering to points, in lateral view wide at base and gradually tapering, curving first caudad, then ventrad and cephalad, with apices directed anteriorly. Styles relatively long and heavy; in ventral view basal two-thirds broad with outer margin more sinuate than the inner, slightly convergent toward middle with apical third curved outwardly, and their pointed apices widely divergent; in lateral view relatively broad at base, narrowing toward apical third, with tip abruptly curved upward.

Sternal apodemes relatively short, about one and one-half times as long as broad, with margins almost parallel and posterior ends broadly rounded. Dorsal apodemes less pronounced, about one-third as long as sternal apodemes and slightly broader.

Described from eleven males taken in trap-lights A and B, Arlington Experiment Farm, Arlington, Virginia, during May and June, 1933. This species was also reared at Arlington Experiment Farm from nymphs collected on willow in 1931.

Type male in United States National Museum collection (Cat. No. 52041). Paratype males in United States National Museum collection and in the collection at entomological laboratory, Arlington Experiment Farm.

NEW SYNONYMY RESULTING FROM STUDY OF EMPOASCA FROM TRAP-LIGHT MATERIAL.

Several species of *Empoasca* whose identities have been somewhat confused have been collected in the trap-lights, and in order to list them properly an effort has been made to determine their exact status. Through the helpful cooperation of Mr. P. W. Oman, Division of Insect Identification, Bureau of Entomology and Plant Quarantine, *Empoasca* material from the Arlington Experiment Farm trap-lights has been compared with certain type material in the United States National Museum. The new synonymy that follows has resulted from these investigations.

Empoasca birdii Goding.

Empoasca birdii Goding, Ent. News 1: 123–124, 1890.
Empoasca infusca DeLong, Ohio Jour. Sci. 32: 398–399, 1932 (new synonymy).

Goding's description of this species, made from external characters only, might apply equally well to a great many

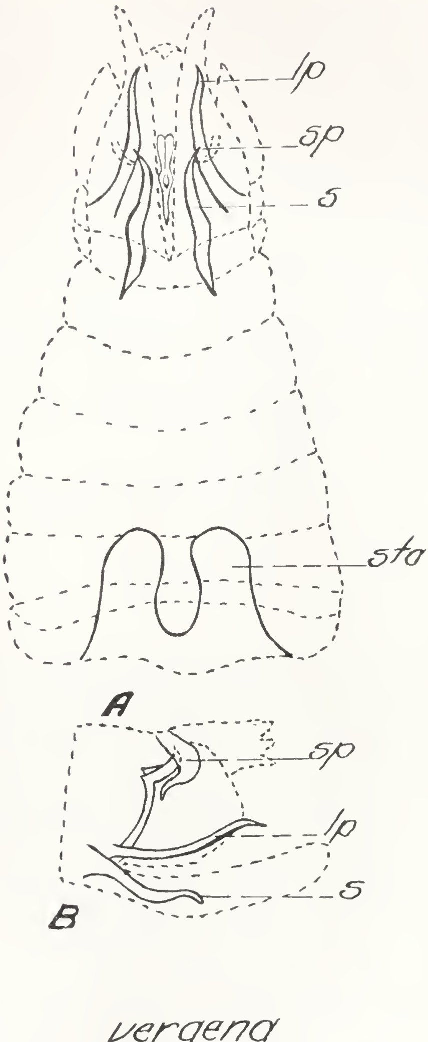


Figure 4.—Internal structures of abdomen of male of *Empoasca vergena* DeL. and Cald.: *A*, ventral view; *B*, lateral view; *lp*, lateral process of pygofer; *s*, style; *sp*, dorsal spine of tenth segment; *sta*, sternal apodeme for muscular attachment.

species of the genus. Because of this, it was considered necessary to look for the type material of this species and to make the identification from that now extant. Therefore, in the search for type material in the National Museum a single male specimen having the necessary data as to locality, date, etc., to be considered one of the type series, was located by Mr. Oman. The internal structures were found to differ from those figured by DeLong (*2*) for *birdii*, but were identical with those described and figured later by him for *infusca*. *Empoasca infusca* is therefore placed as a synonym of *E. birdii* Goding; the specimen labeled "on corn and apple, from F. W. Goding, Rutland, Ill., Nov., 1889," is here designated lectotype of *E. birdii* Goding. As stated by DeLong (*3*) in his description of *infusca*, superfically that species, *birdii*, and *vincula* can not be distinguished, but on the basis of the genital characters they are easily separated. The species treated by DeLong in 1931 as *birdii* appears to be identical with that later described by DeLong and Caldwell (*4*) in 1934 as *vergena*.

Empoasca birdii Goding is represented in the Arlington Experiment Farm trap-light collections by 35 specimens.

Empoasca vergena DeLong and Caldwell.

Empoasca birdii DeLong (nec. Goding, 1890), U. S. Dept. Agr. Tech. Bull. 231: 38, 1931.

In their description of *vergena* DeLong and Caldwell (*4*) state that it resembles *infusca* (which equals *birdii* Goding) in size and coloration. The recognition of the superficial resemblance of *birdii* Goding, *birdii* as identified by DeLong, and *vincula* has already been pointed out. On the basis of genital characters, it would at first seem, from a comparison of the illustration of the species identified by DeLong as *birdii* with the illustration of *vergena* by DeLong and Caldwell, that there is a structural difference between the two. However, in a study of the internal genitalia from a series of both reared and field-collected material at Arlington Experiment Farm, a variation is noted that would explain this difference and would justify the conclusion that these are one species. In the series of reared specimens (male offspring from the same female, obtained in connection with life-history studies) there is a slight variation in the lateral processes of the pygofer, ranging from "almost straight," as in the species identified by DeLong as *birdii*, to "pointed forcep-like apices," as figured by DeLong and Caldwell for *vergena*. Variation in the contour of the lateral pygofer processes is not uncommon in a species of this group and has been frequently observed in the study of a number of specimens of the very common species *fabae*. In *vergena* there seems to be no variation in any of the other internal characters. As

further evidence of the close relation of this series, outside of the one specimen collected in the trap-light, all of the other specimens studied (23 in number) were either reared or collected upon the same host, nettle (*Urtica gracilis* Ait.), and of those collected eleven were taken upon the same date. Also, from females of this reared material, which was then designated as the species identified by DeLong as *birdii*, Balduf (*1*) studied the ovipositors and illustrated the valvular structures which he found furnished characters quite adequate to distinguish the species.

To show the more nearly typical structure in the lateral pygofer processes, the species is re-illustrated (Fig. 4) from a male specimen representing neither extreme, but a modification of these characters. The sternal apodemes are illustrated also, since they offer distinctive and constant structural characters.

Empoasca birdii DeLong (nec. Goding) is therefore placed as a synonym of *E. vergena* DeLong and Caldwell.

Empoasca pallida Gillette.

Empoasca pallida Gillette, Proc. U. S. Nat. Mus. 20: 741, 1898.
Empoasca constricta DeL. and Dav., Ohio Jour. Sci. 35: 31, 1935 (new synonymy).

Gillette described *pallida* from 5 females and 2 males labeled "cotton, N. Car., June, '79." At the present time the type series in the National Museum contains 6 adults, including 1 male, and all but 1 female bearing U. S. N. M. Type No. 3435. DeLong (*2*) pointed out that the type series was a mixed one, and apparently concluded that the particular female bearing Gillette's name label *pallida* represented the species *birdii* DeLong (nec. Goding, 1890). Because of the difficulty, or in some cases the impossibility, of recognizing definitely the females of many species of *Empoasca*, it seems best to place *pallida* Gillette on the basis of the male type, which agrees completely in external characters with the female bearing Gillette's label. This male type, when prepared for study of the internal structures by Mr. Oman, was found to be quite distinct from *birdii* as characterized by DeLong in 1931. The internal male characters are found, however, to be identical with those of *constricta* as later described and illustrated by DeLong and Davidson. *Empoasca constricta* is therefore placed as a synonym of *E. pallida*.

One specimen of this species was taken in trap-light B, June 20, 1932.

Seasonal Occurrence of *Empoasca fabae*.

Empoasca fabae was the first and the last species as well as by far the most abundant, to be collected in the trap-lights

each year. This species was first collected in the trap-lights in the spring during the period May 7 to 15, the same period during which *E. fabae* was first taken in the field each season for several years by sweeping alfalfa and other host plants with insect nets. The earliest record (*8*) for the appearance of adults of *E. fabae* from sweeping in the field at Arlington Experiment Farm was May 10, 1929, when fertile females, collected for life-history cages, produced male offspring identified as *E. fabae*. The earliest date of its appearance in the trap-lights (verified by the determination of males only) was May 7, 1935, when 6 females and 11 males (all *E. fabae*) were caught at trap-light A, after the lights had been in operation since April 2. This was 4 days earlier than the records of previous years for the first appearance in the trap-lights of this or any other *Empoasca* species and may be correlated with the fact that very strong warm southwest winds prevailed May 5 to 7.

In 1934 another interesting record was obtained on the early appearance of *Empoasca fabae*. Both trap-lights had been running since May 6, but nothing was obtained until the night of May 11, when 6 females were caught in trap A and 4 in trap B. The previous day, May 10, there was a strong, warm wind, followed by a dust storm and a thunder storm. The traps were not emptied May 12, but on May 13, in trap-light A there were 353 females and 24 males of the genus *Empoasca* and in trap-light B 6 females and no males. The collection in trap A was phenomenally large for so early in the season, and, correlated with the prevailing weather conditions, would indicate a possible migration from a more southerly location. Identification of the males from this collection yielded 23 *E. fabae* and 1 *E. curvata*, a recently described and rather uncommon species in this locality.

An instance of the practical value of the use of data obtained in these trap-lights, when correlated with observations made under field conditions during the same period, has already been published. Poos (*10*), reported the collection of large numbers of adults of *Empoasca fabae* in the trap-lights at Arlington Experiment Farm each year about June 14, at the same time that a large brood of adults of *E. fabae* was observed maturing on oak and hickory, thus indicating the importance of these hosts in the northward migration of this species each season. A further clue was thereby offered toward a satisfactory explanation of the northward migration of *E. fabae* on these hosts, which was substantiated by means of other studies.

Each year, after its first appearance, the number of *Empoasca fabae* invariably increased as the season advanced, but neither the relative number nor the periodic occurrence of the other species remained constant in the trapped material that it was practicable to identify. During the period from approximately

June 15 to September 5, each year, males of *E. fabae* at the trap-lights were so abundant in proportion to all other species that it was not practicable to attempt to determine the relative abundance of the various species from such collections during that period. Likewise, a large collection of *Empoasca*, attracted to the light in the room, was made at the laboratory window the night of August 29, 1932. Of the 319 specimens caught all but one were males, of which 100, selected at random for identification, proved to be *E. fabae*.

Special periods of migration of *Empoasca fabae* to the laboratory window were observed at other times, during which about 97 per cent of the adults collected were males. No evidence was obtained in this way or at the trap-lights which would indicate more or less regular peak periods, explaining the number of generations through which this species passes during each season, as reported by Lawson (*7*) in Kansas. Six complete generations of *E. fabae* have been reared during a single season at the Arlington Experiment Farm (*8*). In the greenhouse a strain of this species has been bred continuously for several years without passing through any noticeably quiescent stage (*8*). These data indicate that definite broods or generations of *E. fabae* can not be distinguished under field conditions where a large variety of favorable host material is present.

The last species to be taken seasonally in the trap-lights was *Empoasca fabae*, November 21, 1934, 2 females and 1 male being collected after an interval of 18 days when, November 4, 1 female and 8 males (all *fabae*) had been taken. However, the continued operation of the lights until December 5 yielded no further specimens of *Empoasca*. This parallels a record of the latest collection in the field at Arlington Experiment Farm, November 21, 1933, when two collectors made 175 sweeps in alfalfa with an insect net and obtained only 6 males and 6 females (no nymphs), the males being identified as *E. fabae*. The fact that *E. fabae* has not been taken in the trap-lights or in collections made in the field at Arlington Experiment Farm prior to May 7 each year, indicates further that this species migrates northward each season.

SUMMARY.

Trap-lights yielded a large quantity and a great variety of species of *Empoasca*. Records on the occurrence of uncommon or undescribed species may be obtained in this way, and descriptions of two new species and some new synonymy resulting from the study of trap-light material are given. During the period of greatest abundance the males far outnumber the females in trap-light collections, while in field collections the proportion of sexes is reversed. As in the field, *Empoasca fabae*

is by far the most abundant species and the earliest to appear. The period (May 7 to 15), during which *E. fabae* first appears in the trap-light coincides with the earliest appearance of adults of this species in the field. The occurrence of the first large collections of *E. fabea* in the trap-lights is correlated with the maturing of a large brood of adults of this species on oak and hickory in the vicinity. *Empoasca fabae* is the last species of the genus collected in the trap-lights each season. Collections of *Empoasca* in the trap-lights give further indication that *E. fabae* migrates northward each spring.

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NOTES ON THE IDENTIFICATION OF ANOPHELES PSEUDOPUNCTIPENNIS THEOBALD (DIPTERA, CULICIDAE).

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Of recent years, much attention has been given to the larvae of Anopheline mosquitoes, as in some instances they offer better characters for separation of closely allied species than do the adult females, or even the male terminalia. During the course of the author's work, he examined a large number of larvae of *Anopheles pseudopunctipennis* from Panama, and noted a very striking character, which serves as an excellent recognition-mark of the species. A search through the available literature, particularly the works of the late F. M. Root and H. G. Dyar, showed that this character had been overlooked by these workers and others. However, the author found that the character had been discovered in 1927 by Shannon and Del Ponte, who published a description of it in an obscure Argentinian journal (1). The character is found in the postspiracular plates of the larva; the tips of these plates are produced into two thin black tails, which curve upwards at right angles to the plane of the postspiracular plates. In the living larva these tips project through the surface film. As a means of positive identification of the species, this character seems superior to any of those hitherto used, because of its size and easy visibility. In fact, the tails may be seen with a 20X lens. The accompanying photomicrograph shows the tails flattened, and lying in the same plane as the postspiracular plates.

The author has examined material from Argentina, Panama, Mexico, Costa Rica, New Mexico, and California, and finds that the character is present in larvae of *pseudopunctipennis* from all these regions.

The male terminalia of *A. pseudopunctipennis* have been described by a number of American workers. As Root (2) has pointed out, his own earlier description (3) of the mesosome, and the description by Howard, Dyar and Knab (4), were incorrect in stating that the mesosome was without leaflets. Freeborn (5) also described the mesosome as without leaflets. Actually two pairs of very small, delicate, serrate leaflets are normally present.

Dr. F. M. Frost has recently published a comparative study of the male terminalia of Californian Anopheles (6), in which she states that none of the specimens examined by her showed the presence of mesosomal leaflets.

The author, after a number of fruitless attempts to procure male material from California, obtained a male specimen

[1] From the Gorgas Memorial Laboratory, H. C. Clark, Director, Panama City, Rep. de Panama.

collected in Stockton, California, through the courtesy of the authorities of the U. S. National Museum in Washington, D. C. Upon staining and dissecting the terminalia of this specimen, the mesosome was seen to have a pair of delicate leaflets on one side of the tip only, the pair normally present on the other side doubtless having been broken off, as the specimen was over 30 years old, and very brittle, when examined. The accompanying photomicrograph from the Californian specimen shows these leaflets plainly.

The author has examined male material from Argentina, Panama, Costa Rica, Mexico, the island of Grenada in the Lesser Antilles, the States of New Mexico and Texas, as well as the single Californian specimen mentioned, and has found mesosomal leaflets present in material from all these regions. Dr. D. P. Curry informs the author that he has taken specimens of *pseudopunctipennis* in Panama which had an extra pair of mesosomal leaflets, making six in all. Evidently the number of pairs present is somewhat variable.

As the leaflets are so delicate, material in which they are to be demonstrated should be stained (acid fuchsin is excellent), and at least partially dissected. The folds of the anal lobe will effectively obscure the leaflets, and this lobe, at least, should be removed before attempting to see them.

The presence or absence of mesosomal leaflets is of importance as possibly indicating a separation of the species into local races, as has occurred in *A. maculipennis* in Europe. *A. pseudopunctipennis* apparently varies greatly in its habits and ability to transmit malaria in different parts of its range. The work of Barber, Komp, and King (7), and of Barber and Forbrich (8) in New Mexico, shows that it is not important as a vector there. It is not considered dangerous in California. In the highlands of Guatemala it is suspected on epidemiological grounds (9). In Panama it is considered of minor importance, although it is experimentally infectible. On the other hand, Davis (10) has shown that it is the principal vector of malaria in northwestern Argentina, where it enters houses readily, and is avid for human blood.

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Spiracular apparatus of *A. pseudopunctipennis* larva, showing terminal "tails."

Mesosome of specimen of *A. pseudopunctipennis* from California, showing serrate leaflets.

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SIX NEW MITES FROM WESTERN NORTH CAROLINA.

By Arthur Paul Jacot,
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Figures of the following species will appear in a more comprehensive publication. Types are to be deposited at the National Museum.

Megninietta terrena, sp. nov.

Usual length of ovigerous females 0.26 mm., breadth 0.16 mm., length of males 0.2 mm., breadth 0.123 mm.; rostral bristles barely extending beyond rostrum; vertex bristles nearly as long as a leg; abdominal glands conspicuous, longer than one-fourth length of abdomen; abdomen bristles vary in length but are usually only slightly longer than rostral bristles: an anterolateral, a short one anterior to gland, a short one mesad of anterior end of gland, one of normal length laterad of gland and posteriad to gland aperture; a similar one nearly over mesoposterior edge of gland, and two on posterior end of body; legs I similar to those of *Megninietta ulmi* (5) but the short dorsodistal bristle of genual is nearly straight, tibia with a distinct, short, ventrodistal bristle, ungual hook smaller, the dorsal spine distant from hook, ventral spine more distant from distal spines. These distal spines have more the appearance of stays to the hyaline tip of the tarsus than to independent spines.

Cotypes.—Two hundred seventy-five females and thirty-seven males from bits of dead twigs from white pine litter of thirty-year old plantation on old-field, Biltmore estate, tract on Asheville-Brevard road, eight miles south of Asheville, N. Car.; taken October 8th, 1934, slides 34F9w3, -4, and -5.

Although females are common in woodland litter the males are quite rare. Of many litter lots the above is the only one in which males were fairly well represented. Dead wood seems to be their niche.

Histiogaster xylophaga (1, p. 98, pl. 1, figs. 2, 3, 7) from Arizona, is very similar but differs "in the absence of long bristles on tarsi," by the three spines on dorsal face of tarsi I, evident absence of minute bristle under sense club, longer bristle of tibiae I, different tarsi IV.

Pelops silvestris, sp. nov.

Length 0.53 to 0.61 mm., breadth 0.4 to 0.49 mm.; body broad, posterior end truncate to slightly impressed; notogastral bristles so short that the posterior bristles barely project beyond the waxy coating, then bend downward so as to lie parallel to body, other bristles apparently longer, stiff, slightly bent, slightly clavate, well spaced (using Berlese's nomenclature) (2, p. 50; txt. fig.), I^2 more remote than I^1, I^2 a little more remote than distance between I^1 and I^2, L^3 on transverse plane conspicuously posteriad of I^2, L^4 on longitudinal plane slightly but distinctly mesad of L^3, far from I^2, P^1 far down on posterior edge, discernible in dorsal aspect as a slight nubbin in "decorticated" specimens; anterior edge of notogaster with median lobe slight, barely convex, lateral lobes large, as broad as median lobe, the lateral edges thickened; unpigmented area diffuse, rather broad, anterior end broader; lamellae similar to *P. acromios* (3, p. 85, fig. 9A) but cusps more elongate, the lamellar bristles not discernible in dorsal aspect; rostral bristles clavate, pointed, extending to distal end of rostrum but not surpassing it; distal end of tectopedia I extending nearly as far anteriad as rostrum, the space between the tectopedia and sides of cephalon extending far posteriad, interlamellar bristles broad, spatulate, with a distinct midrib, distal end pinched out into a point; pseudostigmatic organs slenderly clavate, extending anteriad to transverse plane of base of lamellar cusps, distal end pointed or rounded, surface minutely burred. Ventral aspect much like *P. acromios* (3, p. 85, fig. 9B) but anal aperture its distance from genital; ad3 and paramesal bristles nearer their apertures; anterior sternal bristles more remote, middle sternals more anterior; tectopedia II quite distinct from ventral plate wings.

Cotypes.—Twenty-one specimens from litter of thirty-year old white pine plantation, on Biltmore estate, Asheville-Brevard road, eight miles from Asheville, N. Car.; taken October 8th, 1934, slide 34F9.1–18.

Zetes pectinatus, sp. nov.

Color pale tan; form rather slender, length 0.41 mm., breadth 0.21 mm.; cephalon tapering; rostral bristles inserted near edge of camerostome, lying close to edge of rostrum, barely exceeding rostrum; lamellae absent; lamellar bristles not discernible (in the two available specimens); insertions distad of distal end of leg cupboards: interlamellar bristles short, upcurved, insertion very small; pseudostigmatic organs flagelliform, coarsely ciliate to pectinate, with six to seven points; anterior edge of notogaster slightly concave (!), porose areas roundish; pteromorphae smooth, thin, with weak rib; adalar porose areas stout; mesonotal circular; no median foramen; ventral plate wings fairly broad; sternum broad, indistinct; sternal bristles remote; genital cover bristles 3 to 6 forming a zigzag; paramesal bristles nearly length of genital covers from genital aperture, more remote than greatest width of genital aperture; anal aperture pseudofissurae long, at center of sides of aperture; bristles ad3 posterior to pseudofissurae; ad1 more approximate than posterior cover bristles; ad2 slightly more distant from ad1 than ad1 are approximate; all bristles of ventral face short.

Easily distinguished from all other Zetes by its pseudostigmatic organs; lack of lamellae; concave midthoracic suture; and reduced cephaloprothoracic bristles.

Cotypes.—One specimen from soil, eleven to thirteen inches deep, of thirty-year old-field woodland, dogwood-pitch pine, Bent Creek Experimental Forest; taken April 15th, 1935, slide 34F30a. One specimen from soil eleven to thirteen inches deep, of an Andropogon bald (Glen Bald), B. C. E. F., Buncombe Co., N. Car.; taken April 17th, 1935, slide 34F32a.

Phthiracarus montium, sp. nov.

Rostrum angular; rim distinct, projecting; carina lacking; rostral bristles remote; pseudostigmatic organs resembling those of *Ph. setosellus* (4, pl. 35) and of same relative size; notogastral bristles of medium length, slender, a1 on collar edge, b3 and c3 with a pseudoforamen almost in line between them; ventral plate without denticles; accessory plate spoon well developed; anterior edge of genital covers without projecting rim, smoothly rounded; posterior half of anal covers concave in lateral aspect; diagonal length of notogaster 0.37 mm.

Cotypes.—One hundred eight specimens from base of litter layer of short-leaf pine stand on Asheville-Brevard road, twelve miles south of Asheville, N. Car.; taken October 15th, 1934, slides 34F10.3Ph2 and –Ph3.

Phthiracarus restrictus, sp. nov.

Aspis with distinct ridge; rostrum with distinct but rounded angle at juncture with ridge; rostral bristles inserted about midway between tip of rostrum and end of ridge; rim well developed but strongly restricted, the rostrum projecting well beyond it; carina distinct; pseudostigmatic organ twisted, distal end upturned, more slender; notogaster high with steep front (as in *Ph. sphaerulus* (4, pl. 33, fig. 2), bristles fine, tapering, of medium length, directed somewhat backward, a1 distant from collar; anterior edge of genital covers without thickened rim, neatly rounded; anal cover bristles II : 2 and III : 1 longer than any of the others, I : 1 and I : 2 quite short; diagonal length of notogaster 0.54 to 0.72 mm.

Cotypes.—Twenty-four specimens from litter of Rocky Cove, Bent Creek Experimental Forest, Buncombe Co., N. Car.; taken September 8th, 1934, slide 34F1–27.

Steganacarus terrapene, sp. nov.

Light horn to olivaceous, sculptured with large areolations separated by slender ridges, both of which are sanded; diagonal length of notogaster 0.32 to 0.56 mm.; aspis high, broad, angular, sculptured except area above and below pseudostigmata; rostrum high, truncate; rostral bristles curved but lying close to anterior edge of rostrum, barely projecting, distal end touching rostrum yet distant from ventral edge; rim of aspis very slender, projecting beyond rostrum; ridge high, prominent, forming nearly a right angle with face of aspis, which is

depressed at sides of ridge; carina lacking; vertex bristles as long as diameter of pseudostigmata, directed forward so as to lie parallel with face of aspis; pseudostigmatic organs long, slender, laterally extended then curving upward, distal fourth slightly roughened, apex pointed; notogaster with very high hood, lapet extending anteriad of hood, that is the projecting hood extends ventrad posterior to lapet; bristles similar to vertex bristles; ventral place denticles strongly developed; anal cover bristles similar to those of *S. diaphanus* (4 pl. 37, fig. 33); anal and genital covers sculptured like notogaster.

An unusually chunky, robust looking species, conspicuous by its huge hood and high, truncate rostrum, and rather elegant sculpturing.

Cotypes.—Two hundred fifty-five specimens from litter of oak woods on east slope of ridge above Poplar Cove, Bent Creek Experimental Forest, Buncombe Co., N. Car.; taken July 15th, 1935, slide 35F6.2–36.

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A NEW ROOT APHID (HOMOPTERA: APHIIDAE).

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The species which is the subject of this paper was first discovered on cotton roots by C. F. Rainwater of the Division of Cotton Insect Investigations, Bureau of Entomology and Plant Quarantine, who has conducted biological studies on it at Florence, S. C. It is described at this time so that the name may be used in publications covering those investigations. Specimens taken on other hosts and in other localities have been in the National Collection since 1900.

Rhopalosiphum subterraneum, new species.

Apterous viviparous female.—Color brown. Body and appendages with long, conspicuous hairs. Antennae much shorter than body, 5-segmented; no secondary sensoria; hairs about twice as long as width of segments and very erect; length of segments: III, 0.17–0.30 mm.; IV, 0.08–0.11 mm.; V, base 0.06–0.08 mm., unguis 0.26–0.46 mm. Head 0.35–0.46 mm. across eyes. Beak reaching to posterior coxae. Cornicles 0.21–0.26 mm. in length, imbricated, slightly

bulging, the flange very prominent. Cauda 0.09–0.12 mm. long, constricted, and with two prominent hairs on each side.

Alate viviparous female.—Color brown, with lateral dark patches showing on abdomens of mounted specimens. Hairs much shorter than in the case of the apterae. Antennae shorter than body, 5-segmented; hairs conspicuous, being about as long as the width of the segments; III with 13 to 23 sensoria along nearly the entire length; IV with 0 to 3 secondary sensoria, usually 2; length of segments: III, 0.30–0.46 mm.; IV, 0.11–0.15 mm.; V, base, 0.07–0.09 mm., unguis, 0.45–0.56 mm. Head 0.41–0.44 mm. across the eyes. Beak reaching to posterior coxa. Cornicles 0.21–0.26 mm. in length, imbricated, less swollen than in the apterae. Cauda 0.08–0.11 mm. long, constricted, with two sets of lateral hairs.

Hosts.—Roots of cotton, okra, butter beans, wheat, oats, barley, *Oenothera laciniata*, *Eleusine indica*, *Gnaphalium* sp., life everlasting, celery, iris. This aphid is nearly always attended by ants.

Distribution.—Maryland, Virginia, North Carolina, South Carolina, Alabama, Ohio, Indiana, Illinois, Missouri, Texas, California.

Type.—Type slide, bearing cotype specimens reared on cotton roots at Florence, S. C., by C. F. Rainwater, deposited in the U. S. National Museum under Cat. No. 52094. Also several slides of paracotype specimens from roots of cotton from the same locality.

Taxonomy.—This species may be separated from the 5-segmented strain of *Rhopalosiphum prunifoliae* (Fitch) by its brown color and by the much longer and more erect hairs on the antennae and body, especially in the apterous form. From *Rhopalosiphum enigmae*, var. *parvae* Hottes and Frison, it differs by the longer unguis in proportion to antennal segment III, by the smaller lateral tubercles, and by the more cylindrical cornicles. Although differing from normal *Rhopalosiphum* in having 5-segmented antennae, the species is placed in that genus for the present, since an occasional specimen is found in which one antenna has faint indications of a sixth segment. Later it may prove advisable to propose a new generic name to include such forms as this species and *R. enigmae* var. *parvae*.

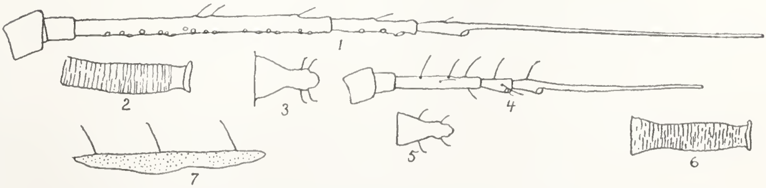

Figure 1.—Alate Viviparous Female.—1, antenna; 2, cornicle; 3, cauda. Apterous Viviparous Female.—4, antenna; 5, cauda; 6, cornicle, 7, abdominal hairs.

THE OFFICIAL SEAL OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

There is reproduced on the cover page of this issue for the first time since 1917, an imprint of the Official Seal of the Society. For those who may not remember the identity of the strange insect depicted on the seal, the following may be of interest: The species is *Rheumatobates rileyi*, Bergroth, a water strider of the hemipterous family Gerridae. It was first collected by J. L. Zabriskie of Flatbush, L. I., N. Y., from a stream on the city water works. An illustration of the apterous male was printed in Insect Life in 1891.[1] The insect is sexually dimorphic and usually apterous. Additional descriptions and illustrations appeared in Insect Life in 1893.[2]

The late Otto Heidemann made the drawing carried on the seal, which is that of the winged male. This form, according to H. G. Barber, seems quite rare. Heidemann collected many specimens of the species on the Potomac Canal, just above Washington, D. C.

The Seal first appeared on the cover of the Proceedings in the issue of March 8, 1894, and was discontinued with the beginning of 1918, when the Proceedings began to be issued as single numbers without formal cover. —*Editor.*

[1] Vol. IV, p. 199.
[2] Vol. V, p. 189.

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PROCEEDINGS OF THE

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BIONOMIC NOTES ON THE COMMON BAGWORM, THYRIDOPTERYX EPHEMERAEFORMIS HAW., (LEPID., PSYCHIDAE) AND ITS INSECT ENEMIES (HYM., LEPID.) [1]

By W. V. BALDUF.

The earliest and most comprehensive contributions to the life history of this moth were made by Riley (69, 69a, 87) and noteworthy additions by Haseman (12), Jones (27) and Baerg (28). Its insect enemies have received comparatively little attention. While no less than eighteen species are now known from it, the desired particulars in their bionomics and the recognition of their immature stages have been left largely undeveloped. Relatively more complete studies of the parasites of Psychidae have been made in South America (Brethes, 17, 20; Bertoni, 24) and in Europe (Zykoff, 11). The writer observed this bagworm and several of its insect enemies in 1932 and 1936 in and about Urbana-Champaign, Illinois. The results are combined below with pertinent records from the literature and notes on three species from the collection of the Illinois Natural History Survey.[2]

NOTES ON THYRIDOPTERYX EPHEMERAEFORMIS.

These observations concern largely the egg-laying capacity of the moth and the effect of repeated abnormally low winter temperatures on the survival of the eggs. Of 257 bags taken from willow in February, 1932, 57 had yielded male moths and 200 had housed females. The lumina of 168 of the female chrysalises contained eggs. Actual counts of the eggs in ten bags taken at random gave numbers as follows per bag: 668, 752, 827, 910, 956, 992, 1083, 1100, 1212, 1315, and 1617, with an average of 1039. Baerg (28) made more extensive counts in Arkansas, and also cites the records of Felt and Girault. While it may not prove to be significant, it is interesting that the

[1] Contribution No. 186 from the entomological laboratories of the University of Illinois.

[2] Determinations were made by R. A. Cushman, A. B. Gahan, Carl Heinrich and C. F. W. Muesebeck, of the United States National Museum. Harry N. Hays and Arthur Ritcher assisted in collecting bags, and materials from the Illinois State Natural History Survey were made available by H. H. Ross and B. D. Burks. All have the sincere thanks of the writer.

average numbers of eggs from bags on willow in Arkansas (1070) and in Illinois (1039) were almost the same.

In February, 1936, 1562 bags were collected from willow, ball cypress, ornamental tamarack, *Rhamnus* sp., black locust and hawthorn, and examined for contents. Approximately 800 of the bags were males, and about 700 females, largely representing the generation of 1935. Of the 1562 bags dissected 390, or approximately 25 percent, contained eggs, all deposited by the moths of the 1935 generation. Oviposition was apparently normal, since the bags were mostly large and strongly built and generally contained sizable masses of eggs. While the eggs counted in 1932 had a healthy stramineous color, 172 of 246 masses found in March and April, 1936, had turned more or less black, yet still remained detached. These later fused together into solid lumps and dried in that state. The eggs in the remaining 74 bags seemed to be in a healthy condition when found, but the most promising clumps, set aside for incubation, failed to yield larvae and eventually turned brown or black, and shrivelled. Checks made in the field in September, 1936, revealed but few bags on willow where they were common in February, and these proved to be old bags of the generation of 1935. They were easily pulled from the branches and contained no living worms, pupae or eggs, or parasites. Since the species went into the winter of 1935–36 with a large number of eggs but failed to produce even a light infestation in 1936, it is plain that some sweeping force served to check them. No evidence of insect enemies of the eggs was found, hence the deterioration of the masses in March and April and the consequent failure of the bagworm to reappear in the season of 1936 is doubtlessly to be attributed to the continued and exceptionally low temperatures to which the eggs were exposed in the winter of 1935–1936. The observation of Forbes (11) that this bagworm is often troublesome in southern Illinois but rarely seen in the northern parts of the State confirms the conclusion that extreme cold was the influence producing this precipitous decline in its numbers in the present instance.

NOTES ON INSECT ENEMIES OF THYRIDOPTERYX EPHEMERAEFORMIS.

Dicymolomia julianalis Walk., Lepid., Pyralidae.

The larva of this plain-colored micromoth has been reported both as a scavenger and as a predator. Specimens in the United States National Museum were bred from the heads of cattail (*Typha*) and from cotton bolls (Dyar, Proc. Ent. Soc. Wash. 09, p. 66). Tucker (11) reared an adult from a larva in a hanging boll of cotton. Heinrich (11) states the larva is frequently found in old and diseased cotton bolls, feeding upon the lint and in some cases on the cotton seeds, but not in green

or healthy bolls. *Typha* is also a food plant, where the larva first eats the styles of the pistillate flowers and later the seeds and the dried up parts of the flower (Claassen, 21).

On the other hand, the larva has been found by several observers destroying the egg masses in the bags of *T. ephemeraeformis*. At a meeting of the Entomological Society of Washington (Proc. 1909, p. 66), A. B. Gahan mentioned finding the larvae feeding on the eggs, whereupon A. L. Quaintance related that he and Mr. Jones had reared it from the same source and on consulting the literature found it had been obtained from bags some years before by C. V. Riley. Gahan (09) informs us further that a large percent of numerous bags collected in Maryland in February contained the larvae of *julianalis* in varying stages of development buried among the eggs in the old pupal skins of the female moths. In every case where a full-grown larva was found the eggs had been completely destroyed. The larvae were again reported from egg masses of *Thyridopteryx* in Maryland by McCreary (30). The inhabited masses were, also in this instance, entirely consumed by the time the larvae reached their maturity.

Dicymolomia julianalis also occurs in Illinois, where the writer found the larvae had entered the egg masses in 25 of the 274 bags collected from willow near Urbana in February, 1932. *Typha* did not grow near this source of bags. Most of the larvae were then one-half to two-thirds grown, while a few were still minute and others quite mature. Invariably they had tunnelled lengthwise through the egg masses, mostly mining through the center, and lining the passage with silk. Some of the larger larvae had destroyed but few eggs in the bags inhabited, a fact that may indicate travel of the larvae from one bag to another, or that their growth was made at the expense of other substances than the eggs. Usually, however, the volume of the egg mass had been reduced to various extents, sometimes only a small part or none of the eggs remaining intact. Concerning the destruction of the eggs, it was not determined conclusively whether it resulted incidentally from the larval activity of burrowing or directly from feeding.

To what category of food habits the larva belongs is suggested in part by the data cited above and the life histories of this species and the bagworm. The latter completes one generation yearly where it occurs in the United States and passes the winter in the egg stage in the bags on plants. The eggs are laid in September and October and hatch in May and June. *Dicymolomia julianalis* likewise has one generation in a year (Claassen), but hibernates in a partly grown larval state in the latitudes of New York, Maryland and central Illinois. In New York, they wintered in the heads of *Typha* (Claassen, 21), in Maryland and Illinois in the bags of *Thyridopteryx*, and in Texas they were

collected from November to April in cotton bolls (Heinrich, 21). So far as observed they pupated in the hibernating quarters. One chrysalis had already developed in the larval tunnel within the egg mass when collected in nature near Urbana on April 23, 1932. In New York, adults appeared in latter June and the early part of July and laid their eggs singly in the pappus of the *Typha* between mid July and August 10 (Claassen).

Several questions must still be answered concerning the advent of the larvae in the bags. Does the female *Dicymolomia* deposit her eggs on plants that chance to grow near bag-worm infestations? Or are they laid directly on the bags themselves? If the first is true, the larvae may make a part of their growth on the oviposition plant, then migrate, perhaps by chance, to the bags. If the second possibility obtains, the earlier larval growth may be made on dead organic matter within the bags. Since *julianalis* had completed its oviposition by August 10 and the eggs of *ephemeraeformis* are not at hand until September and October, many of the larvae of the earlier instars probably must utilize other matter than egg masses as food. Moreover, it is perhaps significant that but few of the larvae have been found in male bags, or in female bags containing no eggs. Their presence in the egg masses in February, and doubtlessly other winter months, may be the culmination of a concentration movement made late in the fall in search of winter shelter rather than food. Since the larvae hibernating in bags are largely immature, they must find food of some kind in the bags for the completion of their growth in the spring, assuming that they pupate where they wintered, as one individual was found to do near Urbana.

Most of the food records show unequivocally that the larva largely eats dead organic matter in the heads of *Typha* and in the bolls of cotton. Dyar (1 c) held the opinion that they were scavengers also in the bags and consumed the eggs of *ephemeraeformis* accidentally. It seems probable that the eggs are destroyed incidental to the preparation of a hibernaculum and not by direct feeding. Eggs so crushed may be regarded as reduced to a condition resembling other types of dead organic matter known to be consumed by this species.

A closely related West Indian species, *Chalcoela* (*Dicymolomia*) *pegasalis* Walk., reported by Ballou (15, 19, 34), appears to have developed a fixed predatory life, since it frustrated attempts to introduce *Polistes crinitus* Felt by destroying the larvae of this Vespoid wasp in the nest.

Parasites of *Dicymolomia julianalis*. Gahan (09) reared the chalcid, *Leucodesmia typica* How. from the bags of *ephemeraeformis* where it was in all probability a parasite of *julianalis*. Another parasite is the ichneumonid, *Cremastus gracilipes* Cushm., reared from cattail by E. S. G. Titus (Cushman, 17).

Tachinidae Sp. Diptera.

Riley (87) writes "We have bred a large bluish tachinid from the bags. Its eggs are commonly attached to the bags externally, near the neck, and the young larvae, on hatching, work their way into the case. They frequently fail, however, to reach the bagworm." Ashmead (86) erroneously credited the discovery of this parasite to Lintner (82). The latter himself correctly attributes the record to Riley. Upon inquiry the the writer was informed by C. F. W. Muesebeck that some old Riley notes dealing with biological observations on the bagworm contain reference to a large specimen of tachinid reared from a pupa. This was subsequently identified as *Archytas aterrima* Desv. However, since the specimen is not present in the collection of the National Museum and the species has not subsequently been obtained from bags, the correctness of the host association remains in doubt.

Other Tachinidae.

The recent paper by Schaffner and Griswold (34) on Macrolepidoptera and their parasites reports three species of this family from the common bagworm. These are *Anachaetopsis tortricis* Coq., *Phorocera claripennis* Macq. and *Zenillia blanda* O. S. A total of thirteen specimens was reared. The host material was secured in the area of New York, New Jersey and Pennsylvania. *A. tortricis* is known also to parasitise the codling moth (R. A. E. A., 19), while the other two species are commonly reported from various other Lepidoptera (Aldrich and Webber, 24). *P. claripennis* occasionally also attacks sawfly and beetle larvae.

The present writer discovered a puparium in each of two bags from *Rhamnus* in Champaign in March, 1936, but did not succeed in rearing adults. The puparia lay in the lumen of the bag beside dead and almost mature bagworms which the larvae had probably parasitised. The puparia were but little larger than those of *Musca domestica.*

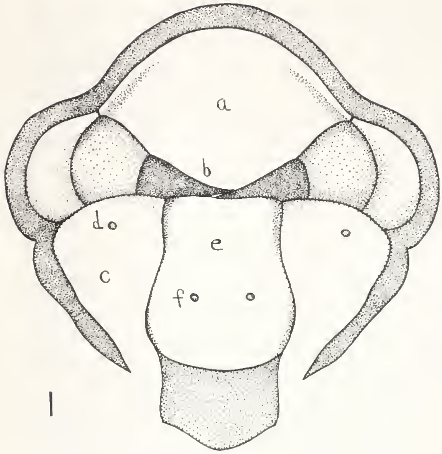
Itoplectis (Pimpla) conquisitor (Say), Hym., Ichneumonidae.

This is a common enemy of many Lepidoptera in North America and sometimes also parasitises other Ichneumonoidea. Original reports of its parasitism on the common bagworm have been made from New York (Litnner, 82), New Jersey (Smith, 07), Missouri (Haseman, 12), Arkansas (Baerg, 28) and Indiana (Montgomery, 33). What is probably this species is illustrated in figure 13 of Jones and Parks (28) from Texas. Schaffner and Griswold (34) reared 74 specimens of it from bags collected in New York, New Jersey and Pennsylvania. The collection of the Connecticut agricultural experiment station contains two

individuals reared at Moorestown, N. J., in the spring of 1933 (W. E. Britton). It is usually described as one of the most effective enemies of the bagworm. Recognition marks of the adult are the narrow whitish to orange band along the apical margin of each dorsal abdominal segment, the short strong ovipositor whose length is approximately one-half that of the abdomen and the clear, uncolored wings. A series of 28 specimens obtained by the writer range from 6.5 to 20 mm. long, exclusive of the ovipositor. Both the largest and the smallest are females. Twenty-six of the series measure between 11 and 14 mm.

Twenty-one of this series were found dead in the chrysalis of the host during April, 1936. They had reached the adult condition and were maturely colored. The remaining seven adults were reared as follows: one female issued Oct. 29, 1928, from a female bag taken by Harold Wright at Marshall, Illinois; five emerged between April 6 and 20, 1936, from bags collected at Urbana-Champaign on March 28 and early April; one female was seen April 13, 1936, resting on the side of the host's bag on black locust. Three females and a male in the collection of the Illinois State Natural History Survey and reared by B. D. Burks, issued from bags at Urbana, December 9 and February 5, 1935. Of the entire series, a large majority was female. Most of the females had developed in female chrysalises and most of the males in the smaller pupae of the male bagworm. Smith (07) reared 285 adults from this host,—177 from male, 108 from female bags. Many other bags dissected by the writer bore evidence of having been parasitised by a large species, presumably *conquisitor*. Emergence of the adult is effected mostly from the lower or caudal end of the chrysalis and through a roughly circular subapical lateral hole cut in the bag. A few issued from the opposite ends of the chrysalis and bag. More than one individual was never obtained from a single case.

A still larger number of the chrysalises of *ephemeraeformis* was parasitised by large legless grubs, never more than one per host. These were in all probability the larvae of *I. conquisitor*, and were quite mature, snugly filling the body cavity of the host, whose contents had been entirely devoured or compressed. The larger individuals occurred in female chrysalises and reached the length of 18 mm. and a maximum diameter of 5.5 mm.; larvae measuring only 12 x 3.5 mm. had developed in the usually much smaller male chrysalises. The structure of the mouth-parts (Fig. 1) readily distinguishes this larva from *Hemiteles thyridopterigis* (Fig. 2).



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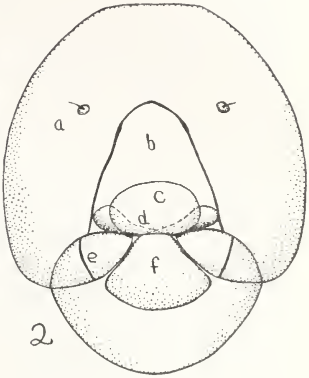

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Explanation of Figures.

Figure 1. Mouthparts of the larva of *Itoplectis conquisitor* (Say). a, labrum and clypeus; b, mandible; c, maxilla; d, maxillary palpus; e, labium; f, labial palpus.

Figure 2. Facial structures of the larva of *Hemiteles thyridopterigis* Riley. a, antenna; b, clypeus; c, labrum; d, mandible; e, maxilla; f, labium.

In its relation to the common bagworm, *Itoplectis conquisitor* is therefore a solitary, internal, primary parasite, killing the host in the chrysalis form. Numerous other records (Rev. Appl. Ent., Ser. A, 1913–34) show that the adult issued from the chrysalis also where other species of Lepidoptera were the hosts. According to Weed (00), Stearns (19), and Johnston (13), the female oviposits in the newly spun-up larva, the prepupa or the freshly transformed pupa of such other hosts. The female was seen by Johnston to feed at intervals on body juices that exuded when the ovipositor was pumped up and down in the larva of *Autographa brassicae*.

The winter appears to be spent both in the adult stage and in an immature form. Adults issuing from bags between the extreme dates of Sept. 4 and Nov. 8 have been reported from New Jersey, Indiana, New York and Illinois. Accordingly the adult *I. conquisitor* seems mostly to leave the bags before winter. On the other hand, the discovery of dead larvae and newly-formed pupae in the host in late March, and the emergence of several adults between Dec. 9, 1935, and April 20, 1936, in Illinois shows that some hibernate, probably as mature larvae, if not as pupae, within the host chrysalis.

Cushman (18) points out that the "*Cryptus inquisitor* Say"

of Glover (66 ; 87) was in fact *Itoplectis conquisitor* Say. In the first reference, Glover describes his parasite from the bagworm "in the middle states" as "a small yellow-banded ichneumon fly," and in the second states it was reared from the same host in the grounds of the Smithsonian Institution, in Washington, D. C., and pictures the adult (Fig. 29). Riley's (69) statement that *C. inquisitor* Say is "The only parasite which has been hitherto known to attack this bagworm" certainly refers to Glover's first record. The synonymous name *Pimpla inquisitor* Say has been employed in most later papers concerned with the parasites of this host, and, in view of the above misidentification, it seems probable that most, if not all, of these were actually *Itoplectis conquisitor*, or possibly in some cases the superficially similar *Epiurus indagator* (Cress.) which is also one of the common larger parasites of this bagworm. In a letter to the writer, Mr. Cushman informs that *Pimpla inquisitoriella* Dalla Torre is a substitute name for *P. inquisitor* Say, and both these are synonyms of *Iseropus coelebs* (Walsh). The latter is the species which Howard (97) had from the white-marked tussock moth and that Fiske (03) reports from the American tent caterpillar under the name *Pimpla inquisitor* Say. But it is not yet clear whether *I. coelebs* is ever parasitic also in the bags of *ephemeraeformis*.

Epiurus indagator (Cresson), Hym., Ichneumonidae.

Fifteen females and one male were reared between March 23 and April 18, 1936, from bags collected in and near Urbana, on March 31 and April 13 and 18. The adult female bodies range between 7.0 and 9.0 mm. in length, and the ovipositors from 4.5 to 6.0 mm. The abdomen is approximately 0.5 mm. shorter than the ovipositor. The single male measures 7.0 mm. The head, thorax and abdomen are uniformly black, the coxae and femora shiny reddish brown, trochanters more or less white and tibiae and tarsi white and black.

Bags dissected in the earlier part of the above period contained some mature larvae, indicating that the species wintered in that state. These pupated promptly when kept indoors a few days, and bags gathered on April 18 were found on the same date to contain more or less mature pupae. Hence, development was renewed in nature about mid-April. Whether found as larva, pupa or newly transformed adult, all these parasites occurred within the chrysalis of the host, both male and female *ephemeraeformis* being subject to attack. While the majority of chrysalises were inhabited by a single parasite, several contained two larvae, or a larva and a pupa. In the instances of dual parasitism, the lumen of the host's body was divided longitudinally into two chambers of approximately equal size by a mesal wall of silk. Of fourteen female parasites, whose individual

host is known, eleven developed in male chrysalises while only three came from the larger female hosts. This series of fourteen included one instance of dual attack, the host in this case being a male chrysalis.

E. indagator (Cress.) is known also to parasitise other Lepidoptera, the adults issuing either from the caterpillars or the pupae of the hosts. (Rev. Appl. Ent. A., 1913–1934.)

Hemiteles (Allocota) thyridopterigis Riley, Hym., Ichneumonoidea.

Riley (69) described this parasite from materials obtained by Miss M. E. Murtfeldt from the common bagworm in Missouri. The female has a reddish-brown body, a spindle-shaped abdomen, the ovipositor as long as the gaster, a broad brown transverse band on the apical half of the wing and a brown blotch on the basal part. The male is described as black, slender and lacking the wing markings. Fifty-six females in the collection of the Illinois State Natural History Survey range from 4.5 to 10.00 mm. long. No males occur in this series. Since the original report, this species has been recorded from Missouri (Haseman, 12) Connecticut (Britton, 16), Arkansas (Baerg, 28), Indiana (Montgomery, 33), Texas (Jones and Park, 28, fig. 13) and the region of New York, New Jersey and Pennsylvania (Schaffner and Griswold, 34). The Illinois series of 56 females was reared from bags collected at Makanda (Sanborn), Springfield (Rundles) and Marion, Ill. (Ross and Mohr), and at Lake Tomalta, Texas (Hart). The writer has it from Champaign.

The adult has been reared on the following known dates: Sept. 4 to Oct. 4, Indiana (Montgomery); Sept. 9, 1908, and June 22 to July 7, 1909 (Sanborn), Aug. 24 to Sept. 22, 1910 (Rundles) and May 15 to June 10 (Ross and Mohr), Illinois.

Riley (69) describes the cocoons of this parasite as "tough white silken," whereas those in the above Sanborn bags are brown. Two bags containing brown cases were discovered in a lot from Champaign on April 11, 1936. In their form and arrangement they are like those figured (fig. 10) by Riley. They are medium to dark brown, tough, 10 to 14 mm. long by 3 mm. in maximum diameter, spindle-shaped, lie lengthwise in the bag and attached to its inner walls and also to each other when enough are present to fill the cavity. In one instance they were massed in the upper two-thirds of the bag, this mass consisting of six cocoons; only three were present in the second bag.

Dead but still flexible larvae were found in these cocoons. Figure 2 represents the head structures drawn from these larvae and dried specimens removed from the above Sanborn series from which adults also have been reared. The larvae from which the drawing was made are therefore doubtlessly

those of *H. thyridopterigis*. Since the larvae had spun their cocoons, which they filled snugly, they had reached maturity, then measuring 5 mm. in length. The characters of the mouthparts easily distinguish this species from the other two illustrated in figures 1 and 3.

Hemiteles thyridopterigis, when attacking *T. ephemeraeformis*, is superparasitic. According to Riley (69), the larva "lives in the body of the worm to the number of five or six at a time" and later (87) stated it is the "most abundantly bred" of the bagworm parasites. Haseman (12) reports as many as eight specimens from a single bag. The two bags reported above by the writer contain three and six cocoons, respectively. The question of its relation to the host remains largely unanswered. While Riley at first stated the larva "lives in the body of the worm," he subsequently (87) inferred from what he knew of the habits of other *Hemiteles* spp. that it may be hyperparasitic. Felt (05) shared the view that it is probably a hyperparasite on the "Pimplas" which directly attack the bagworm, and Britton (16) states that the Ichneumons, *Itoplectis* (*Scambus*) *conquisitor* and "*S. inquisitoriellus*," primary parasites of *T. ephemeraeformis*, are the hosts. Haseman regarded it as an extremely effective parasite against the bagworm, and Baerg had it in considerable numbers from nearly mature bagworm larvae in 1926 and 1927 in Arkansas. In the bags taken in Champaign, 1936, the writer found only the remains of fairly mature bagworms, but grants that six larvae of *H. thyridopterigis* could easily have reduced the larva of *Itoplectis conquisitor* to an unrecognizable state, should the latter have been present as a primary parasite of the bagworm. While certain other species of *Hemiteles* clearly attack other Ichneumonoidea as their direct hosts, still others are reported to parasitise sawflies, Lepidoptera and beetles. It is recognized that observers sometimes fail to give consideration to the question of the precise host relations of parasitic insects.

An Undertermined Ichneumonoid Parasite.

Two bags taken at Monticello, Ill., on April 11, 1936, contained numbers of dead but still whitish flexible and whole larvae whose features indicate they are a species of Ichneumonoidea. It seems not to have been reported heretofore from bagworms. The head structure, shown in figure 3, is much more reduced than that of *Itoplectis conquisitor* (fig. 1) or *Hemiteles thyridopterigis* (fig. 2). The larvae inhabited chrysalises of female *ephemeraeformis* which they had emptied entirely of their contents and now packed full with their own bodies. One chrysalis contained 19 of the parasitic larvae, which measured 6 to 8.5 mm. in length; the other 16, which were larger on the whole, or 8 to 9 mm. long. No cocoons had been formed.

Phobetes albinopennis Davis, Hym., Ichneumonidae.

Davis (97) described it from two specimens taken in South Dakota and Florida. Haseman (12) reared it from bagworm cases in Missouri and ranked it as one of the smaller and less abundant parasites which he had from that host.

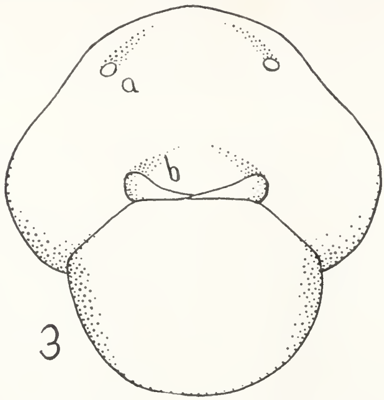

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Figure 3. Facial structures of the larva of the "undetermined Ichneumonoid parasite." a, antenna; b, mandible.

Habrocytus thyridopterigis Ashm., Hym., Petromalidae.

It is believed that the bagworm parasite reported by Lintner (82) and Riley (87) as "*Pteromalus* sp.," is the form now known as *Habrocytus thyridopterigis* Ashm. The head and thorax are deep metallic green, the abdomen blue and polished. Some of the females reach 4 mm. in length, whereas the males measure approximately 2 mm. Lintner found 16 specimens ("*Pteromalus* sp.") at rest or moving over bags in October-November in New York, and Haseman reports them the most abundant of the small parasites reared from bags in Missouri.

The writer reared 125 individuals, — 77 females and 48 males, — from bags taken at Urbana-Champaign and Monticello, Illinois, in March and April, 1936. The number varied between three or four to 49 from a single bag. Observations on living stages in bags showed that the species wintered largely as mature larvae. A few were still immature when found on the dead hosts in March and April. The larvae pupated without making cocoons, and became adults in latter April in nature, but in March and April indoors. Following are notes on the more significant lots reared.

Lot 1. Twenty-one male and twenty-eight female adults developed April 1–3 from pupae that had transformed newly on March 28, in a female chrysalis of the bagworm. The

contents of the chrysalis had been reduced by the parasitic larvae to an extent that made determination of the exact host impossible. The cavity contained exuviae of this chalcid and pellets of its excreta.

Lot 2. Seventeen females and three males were reared from their larvae and pupae in another chrysalis of a female bagworm in March and April. In this instance the chrysalis contained remains of an Ichneumonid larva (Fig. 1), doubtlessly that of *Itoplectis conquisitor*, which was found in an extreme state of collapse and dotted with excreta cast by the larvae of *Habrocytus thyridopterigis* incident to their pupation.

Lot. 3. Six adults developed from larvae externally parasitic on a pupa of *Itoplectis conquisitor*, the latter occurring in a female chrysalis of the bagworm.

Lot 4. Two other bags contained recognizable remains of three species of insects,—parts of a bagworm, the brown cocoons of *Hemiteles thyridopterigis*, and the living larvae and pupae of *Habrocytus thyridopterigis*. The *Habrocytus* were found within the cocoons of *Hemiteles* and were doubtlessly parasitic either on the larvae or pupae of the latter. Howard (97) describes an instance of a similar relation involving these species.

These instances show that *Habrocytus thyridopterigis* as found in the bags of *Thyridopteryx ephemeraeformis* is a superparasitic external hyperparasite,—having a secondary relation when attacking the larva or pupa of *Itoplectis conquisitor*, and is possibly tertiary when it develops in the cocoons of *Hemiteles thyridopterigis*, the latter then parasitising *Itoplectis conquisitor*.

Spilochalcis mariae Riley, Hym., Chalcididae (s.s.).

Riley (87) recorded it as a parasite of the common bagworm, but added that it is more partial to the large silkworms (Saturniidae). Baerg (28) also reared it from this psychid in Arkansas. H. H. Ross and C. O. Mohr of the Illinois State Natural History Survey obtained about 375 adults from a lot of bags numbering approximately 300, which they collected at Marion, Illinois, February 21, 1933. The adults issued from the bags indoors between Feb. 21 and March 17, 1933, many individuals emerging from a single bag. They range between 4.0 mm. and 6.5 mm. in length, the males mostly being much smaller than the females. This material was determined by H. H. Ross and B. D. Burks. Like *Brachymeria ovata* Say, below, it has greatly enlarged hind femora and is distinguishable by the predominately yellow body variously marked with black. It may prove to be a primary parasite of the bagworm.

Brachymeria (Chalcis) ovata Say, Hym., Chalcididae (s.s.).

The adult is about the size of *S. mariae*, but its color is largely black with tegulae and legs, in part, orange. Lintner (82) was

the first to record it from the common bagworm. The collection of the Illinois Survey contains two females, determined by B. D. Burks,—one of which was reared by Dr. S. A. Forbes, Sept. 10, 1900, the other by C. A. Hart, Sept. 17, 1909, at Springfield, Ill. This chalcid is a widely-distributed common primary parasite of various Lepidoptera, ovipositing in some recorded instances in the newly-spun cocoons of the mature caterpillars, and has often been recorded (Rev. Appl. Ent., A) issuing as an adult from the pupae of its hosts. Howard (97) reports it from the chrysalises of *T. ephemeraeformis* and other moths.

Dibrachys cavus Walk. (**boucheanus** Ratz.), Hym., Pteromalidae.

Perhaps no other species of parasitic Hymenoptera is reported more frequently in the literature than this small chalcid (R. A. E., A, 1913–34). It is about 2 mm. long, occurs in both Europe and America, and its host relations are various. Most often it is a secondary parasite in the cocoons of Ichneumonidae which attack lepidopterous, and sometimes coleopterous, larvae, but occasionally develops directly on caterpillars. Not infrequently it has been obtained from the puparia of Tachinidae parasitic in other insects of various orders. Rarely its direct host has been another chalcid or even other individuals of its own species. In the case of the bagworm, Howard and Chittenden (08) state it is probably a secondary parasite. It is one of the bagworm enemies reared by Haseman (12) in Missouri.

Eupelmus cyaniceps amicus Gir., Hym., Eupelmidae.

Girault (16) described this chalcid variety from specimens that developed on the mylabrid beetle, *Bruchus amicus* Horn. Other records show it also parasitises *B. brachialis* Fabr. (Bridwell and Bottimer), the sunflower weevil (Bigger), the cotton boll weevil (Fenton and Dunnam), and the pupae of the oriental fruit moth (Nettles). Baerg (28) reared it from the common bagworm in Arkansas.

Dinocarsis thyridopterigis Ashm., Hym., Encyrtidae.

This chalcid was added to the list of bagworm parasites by Ashmead (86). He states it "is evidently parasitic on the eggs enclosed" in the bag, but further observations to confirm this view are lacking. These specimens were reared from bags taken in Florida. Riley (87) repeats the statements of Ashmead.

Trichogramma minutum Riley, Hym., Trichogrammatidae.

Although the eggs of *Thyridopteryx ephemeraeformis* are not known to be parasitised by *T. minutum* in nature, Peterson (31)

succeeded in using them as laboratory hosts of this minute chalcid.

Other Species of Chalcidoidea.

Among the parasitic species obtained in smaller numbers from bagworms in Missouri, Haseman (12) records two undetermined chalcids,—one *Pteromalus* sp. (Pteromalidae), the other *Tetrastichus* sp. (Tetrastichidae).

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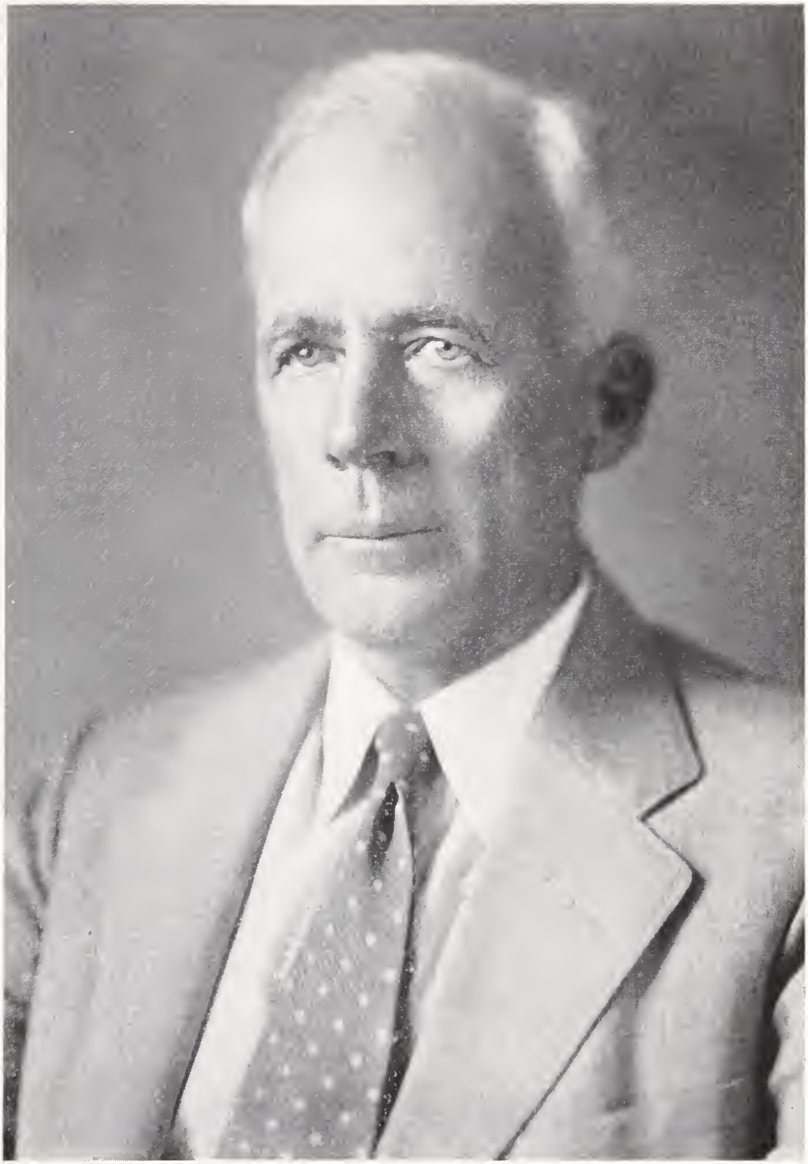
IN MEMORIAM:

GERSHOM FRANKLIN WHITE.

By F. C. Bishopp and C. E. Burnside.

On April 27, 1937, at Moorestown, N. J., death called from among us Dr. Gershom Franklin White, the leading authority in this country on diseases, other than fungi, which affect insects. Dr. White was born at Hooksburg, Ohio, December 22, 1873. He obtained his early education in the public schools of Ohio and received a B. S. degree from Ohio University in 1901. He continued his training as a graduate student at Cornell University and received a Ph. D. degree in 1905. In 1909 he received a degree of M. D. from George Washington University. During spare time and leave of absence from employment from 1922 to 1926 he did additional graduate work at Johns Hopkins University, taking courses and doing research in subjects related to investigations in the field of medicine that he was carrying on for the United States Department of Agriculture.

Dr. White took up the investigation of diseases of honeybees while a student at Cornell University. Reports of his early studies on diseases of bees were published by the New York State Department of Agriculture in 1903, 1904, and 1905. From 1903 to 1906, while continuing research on diseases of bees, he served as instructor in comparative bacteriology at Cornell University. He entered the service of the United States Department of Agriculture in 1906 as an expert in animal bacteriology in the Bureau of Animal Industry. During that year a 50-page report on the bacteria of the apiary with special reference to bee diseases, which was prepared by Dr. White as a thesis at Cornell University, was published as a Technical Series bulletin of the Bureau of Entomology, United States



GERSHOM FRANKLIN WHITE.
(Photo Harris & Ewing)

Department of Agriculture. This report did much to clear up the confusion that existed regarding certain serious diseases of the brood of bees. Previous to Dr. White's investigations it was believed that only one bacterial disease of the brood of bees existed. It was shown by his report that the name "foulbrood" was being applied to two distinct bacterial diseases and that there existed a third brood disorder known among beekeepers as "pickle brood." The two bacterial diseases were named American foulbrood and European foulbrood and their causative organisms were described by Dr. White as *Bacillus larvae* and *Bacillus pluton*, respectively. In 1907 Dr. White entered the employment of the Bureau of Entomology as insect pathologist. With the exception of the period October 18 to December 27, 1918, when he served in the United States Army as captain in the Medical Corps, he continued with the Department most of the time until his death. His most notable work on diseases of honeybees was done while in the employ of the Department. His observations and discoveries concerning diseases of bees were reported in a series of papers, several of which are monumental in the field. Four technical publications in particular, entitled "American foulbrood," "European foulbrood," "Sacbrood," and "Nosema disease," have done much to advance knowledge of these serious diseases of bees which are present in every major beekeeping region of the world. Dr. White's works in this field have served as a foundation for succeeding investigators. They have also proved invaluable to apiary inspectors and beekeepers in this country and abroad in the diagnosis and control of diseases that affect honeybees.

In 1917, while continuing his work on diseases of bees, Dr. White took up the study of diseases of other insects. These investigations were interrupted by his military service, but in the years that followed he discovered and described diseases of a number of different insects and named the pathogenic organisms. In 1923, reports of his investigations on hornworm and cutworm septicemia were published in the Journal of Agricultural Research. Other insect diseases that Dr. White described include a neosporidian infection of flour beetles; a protozoan and a bacterial disease of the Mediterranean flour moth; septicemia of the Colorado potato beetle; pink bollworm septicemia, and polyhedral diseases of insects. He also devoted some attention to causes of death among screwworm flies. This work was carried on at Valdosta, Ga., during portions of the years 1936 and 1937.

During the period 1930–34 much of Dr. White's attention was given to investigations of methods of producing and shipping sterile maggots for the use of surgeons in the Baer method of treating osteomyelitis and other suppurating lesions in man.

Although a complete report of his work in this field has not been issued, some of the noteworthy results were published in brief abstracts in the December, 1932, and December, 1934, numbers of the Journal of Parasitology.

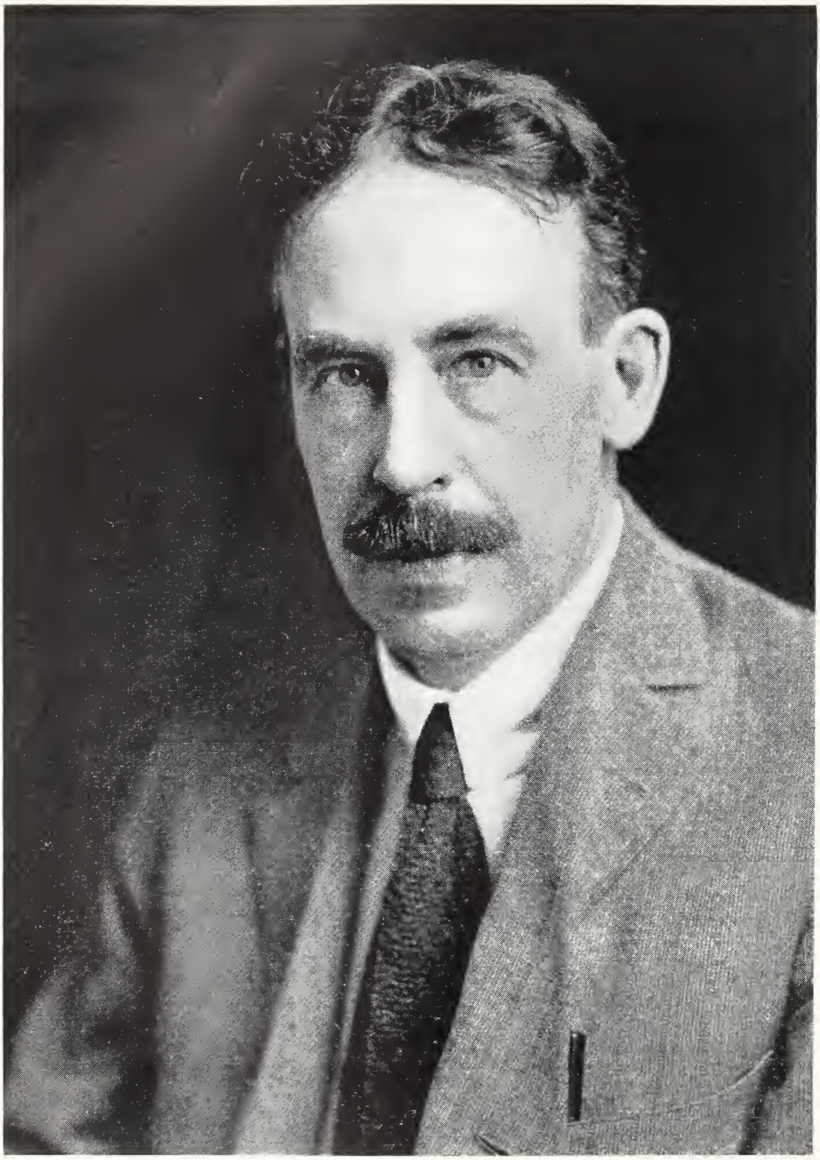
In July, 1924, an investigation was begun by the Bureau of Entomology to determine the cause of a malady of man in the South known as creeping eruption. Soon after this Dr. White, because of his knowledge of pathology, was asked to work with W. E. Dove, who was assigned to the problem and was collaborating with Dr. J. F. Kirby-Smith in Jacksonville, Fla. These investigations led to the determination that the trouble was due to the larvae of one of the dog and cat hookworms, *Ancylostoma braziliense*, which had not been known previously to cause creeping eruption of man. These investigations yielded much information on the habits of this nematode and on methods of preventing infestations and treating the disease in man.

When Dr. White's work was terminated by his untimely death, he was studying diseases of the larvae of the Japanese beetle. He became connected with this work in September, 1933. Previous studies by others indicated that certain endemic diseases appeared to be responsible in part for variations in the larval populations of the beetle in the soil. Among the diseases under investigation, one, designated "milky disease, type A," had been found to be highly pathogenic. The work upon which Dr. White was engaged related to the infectivity and longevity of this casual agent and he was particularly interested in the possibility of its mass production by artificial methods. He believed that the diseases of the Japanese beetle can be made to serve a useful purpose in the control of that insect, and the laboratory and field studies of methods of using them in a practical way will be continued by his former associates in the work.

In Dr. White's death science has lost an enthusiastic, diligent, and painstaking investigator, unassuming, yet always ready to give unstintingly from his fund of information on bacteriology, pathology, and helminthology to any one inquiring, whether friend, co-worker, or struggling student.

At the Cosmos Club, of which he was a member, and on the golf links, where he was an enthusiastic devotee of the sport, a large circle of friends will miss his kindly face and genial companionship.

Dr. White was not married. He is survived by a brother and three sisters.



WILLIAM MORTON WHEELER IN 1916.
(PHOTO J. H. PAINE)

OBITUARY NOTICE : WILLIAM MORTON WHEELER.

William Morton Wheeler, internationally known zoologist and educator, and member of the Entomological Society of Washington since June 12th, 1892, died suddenly at Cambridge, Mass., on April 19th, 1937, at the age of seventy-three.

Born in Milwaukee, Wisconsin in 1865; he received his early education in German schools in that city, and subsequently completed his formal education on receiving a Ph. D. degree from Clark University, but this degree represented only one step in his progress through a continually broadened field of knowledge and his success in further explorations in this field is evidenced by the honorary degrees given to him by American educational institutions, the degree of Sc. D. having been conferred on him by the University of Chicago in 1916, by Harvard University in 1930, and by Columbia University in 1933, while the LL. D. degree was conferred on him by the University of California in 1928.

Professor Wheeler's career as a teacher began early when he undertook teaching in a Milwaukee high school. Subsequently he held academic positions at the University of Chicago, at the University of Texas, and at Harvard University, these connections occupying his active career except for a period of about five years during which he was Curator of Invertebrate Zoology at the American Museum of Natural History. His official teaching career culminated with his retirement from the faculty of Harvard University in 1933, four years after he relinquished the deanship of the Bussey Institution for Research in Applied Biology. A prolific writer—his bibliography includes over four hundred titles—on a wide variety of scientific subjects, it is beyond the purpose of this notice to undertake to appraise the value of this published work. For many of the members of the Entomological Society of Washington, his papers on ants will probably stand out as models of broad treatment of difficult taxonomic problems. The influence of his more philosophical papers and the perhaps even stronger influence resulting from the far-seeing enthusiasm with which he approached both his own problems and those of his students and fellow-workers who had opportunity for frequent contact have been elaborated by some of those who have had the privilege of such frequent and intimate association.[1] Certainly his influence on the science of entomology has been a deep and a permanent one, a fact that had received wide recognition before his death through such elective honors as fellowship in the National Academy of Sciences, the American Academy of Arts and Sciences, the American Philosophical Society, honorary fellowship in the

[1] See Science, v. 85, June 4, 1937, p. 533; Scientific Monthly, v. 44, n. 6, June, 1937, p. 568; Ann. Ent. Soc. Am. V. 30, No. 3, Sept. 1937, p. 433.

Royal Entomological Society of London, the Société Entomologique de France, and the Société Entomologique de Belgique, and others.

It is more fitting for others, as it were, to weave and lay upon his tomb wreaths and garlands in appreciation of his great scientific attainments. It is for us, here, merely to give expression of our loss in the passing of a member of our Society in whom we recognize rare qualities of intellect, of character and of personality.

H. G. Barber,
J. S. Wade,
Harold Morrison.

FREDERICK WILLIAM URICH, 1870–1937.

According to Trinidad papers Professor Frederick William Urich died at his residence in Port of Spain on July 22d last.

The very sympathetic obituary states that "the Colony has suffered a very severe loss by the death of this distinguished son, an esteemed authority in natural history, especially economic entomology, which will be felt for many years" and gives a detailed report on his career in the island.

Urich was born in Trinidad in June, 1870, and received his early education there, continued it in Frankfort, Germany, and finally at Geneva, Switzerland, where he specialized in entomology.

Although intensely interested in entomology and, even in his early years, collecting insects and corresponding with scientists abroad and in the United States, he was for many years employed in the Colonial Government service as bookkeeper and accountant and eventually as Inspector of Schools and Librarian in the Colonial Secretariat. Not until 1909 was his entomological training and ability utilized by the Islands Board of Agriculture and only in 1920 did he receive full recognition as Entomologist in the Department of Agriculture.

Urich became Assistant Professor of Entomology and Zoology at the Imperial College of Tropical Agriculture, which post he held until June, 1934, when he retired. His excellent entomological work in Trinidad is well known, especially his exhaustive work on the froghoppers on sugarcane and their egg parasites and his work with the thrips on Cacao; these studies and his recommendations for the control of these insects brought him proper appreciation from the planters on the island, but Urich was probably even more appreciated by his numerous correspondents in the United States and abroad on account of his ever-ready help in procuring desired material for the various specialists. He corresponded with nearly all of the older set of

entomological specialists of the Department of Agriculture and the National Museum, Howard, Schwarz, Dyar, Knab, Heidemann, Ball, Green and Busck, and much of our knowledge of Trinidad insects is based on his material and his notes. The older members of our Society will remember Urich's genial personality from his visit in Washington in 1911, when he gave some talks on his froghopper work before the Society.

—A. B.

A NEW ERIOPHYID MITE FROM LEMON TREES (ACARINA : ERIOPHYIDAE).

By H. E. Ewing,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

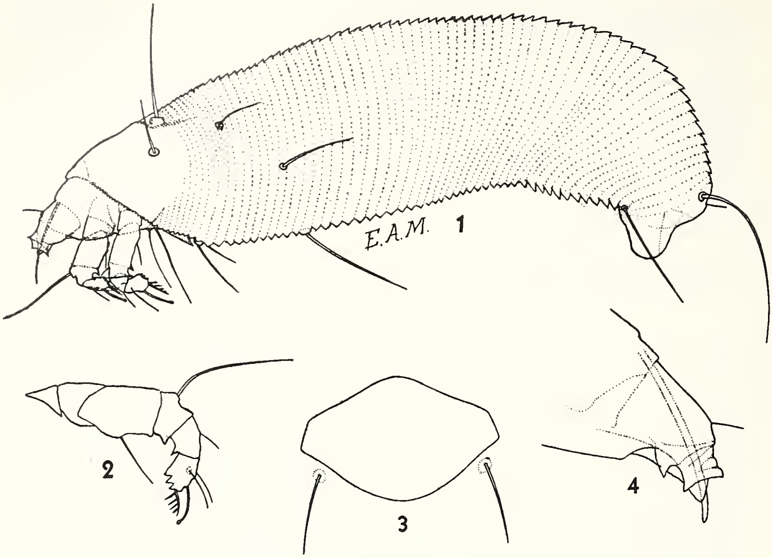
The new mite here described was first found and its injury first recognized by Howard Sheldon, entomologist in charge of pest control operations on the Limoneira Ranch, Ventura County, Southern California. Early observations on its habits were made by E. A. McGregor, of the Bureau of Entomology and Plant Quarantine. He has furnished the writer with a drawing of the species and a photograph showing its injury to lemon trees. The latter consists of a deformation of the ends of the twigs, and is caused by the mites working in the buds. It will be described in detail by others.

This mite is a member of the family Eriophyidae, a group popularly known as the gall mites. It should be stated, however, that probably most of the species of this group do not produce true galls and many of them cause no malformation whatever. The species here considered is a member of the genus *Eriophyes*.

Eriophyes sheldoni, new species.

Body long, vermiform, for the most part cylindrical. Cephalothorax in side view arched above like a segment of a circle. Middle and lateral fields of shield narrow. Dorsal seta large, situated on low tubercle, in length equal to cephalothorax excluding palpi. Abdomen very long. Lateral seta inconspicuous, situated on a low tubercle and at about its length from anterior and dorsal margins of abdomen; caudal seta longest of all, in length about equal to greatest width of abdomen; accessory seta present, minute; ventral seta I more lateral than ventral in position, slightly longer than lateral seta; ventral seta II situated near median line, slightly longer than ventral seta I; ventral seta III situated near base of caudal lobe and extending for about one-half its length beyond apex of the latter. Caudal lobe broadly rounded posteriorly. Legs of medium length. Empodium of each tarsus with four pairs of barbs and surpassed by a slightly curved tarsal claw. Number of abdominal rings 60 to 70, counting those that are incomplete.

Total length of body, 0.131 mm.; height at base of abdomen, 0.036 mm.



Eriophyes sheldoni, new species; 1, profile view of female; 2, right Leg I, viewed from without; 3, genital plate and setae; 4, mouth parts, viewed laterally. Drawn by E. A. McGregor.

Type host.—Cultivated lemon tree.
Type locality.—Santa Paula, California.
Type slides.—U. S. N. M. no. 1276.

Described from many specimens taken from type host at type locality June 17, 1937, by E. A. McGregor and on the same host at the same place June 30, 1937, by A. M. Boyce, of the Citrus Experiment Station at Riverside, California.

Mr. Boyce reports that following the discovery of this mite in lemon buds a rather hasty survey of the wild plants in the same vicinity was made in an attempt to locate the source from which the infestation of lemon trees came. This resulted in the collection from a plant of the genus *Salvia* of an *Eriophyes* species, which has been forwarded to the writer for study. The specimens taken from *Salvia* differ from those taken on lemon trees in several minor points and very decidedly in the number of abdominal rings. In the species on *Salvia* there are from 45 to 50 abdominal rings, counting the incomplete ones, while in the species here described as new there are from 60 to 70 abdominal rings, counting the incomplete ones.

SOME MORPHOLOGICAL DIFFERENCES BETWEEN THE SCREWWORM FLY COCHLIOMYIA AMERICANA C. & P. AND OTHER CLOSELY ALLIED OR SIMILAR SPECIES IN NORTH AMERICA (DIPTERA : CALLIPHORIDAE).

By Emory C. Cushing,
Division of Insects Affecting Man and Animals,
and
David G. Hall,
Division of Insect Identification, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Washington, D. C.

Because of the importance of the primary screwworm fly, *Cochliomyia americana* C. & P., in the southern part of the United States, it is the purpose of this paper to present characters by which species of *Cochliomyia* and of certain related genera may be differentiated by workers engaged in an economic study of flies causing wound myiasis in man and animals.

Species of *Cochliomyia*, *Compsomyiops*, *Chloroprocta*, and *Hemilucilia* bear a common superficial resemblance to one another in exhibiting bright yellow to orange-red faces, genae, and buccae, and metallic blue to bluish-green body coloration. Most of the species possess three distinct dark longitudinal stripes on the dorsum of the thorax.

The genus *Cochliomyia* may be immediately separated from related genera by the shape and size of the palpi, these being very short and slender in *Cochliomyia;* elongate and more or less club-shaped in the others. *Compsomyiops* is separated from the others by the presence of hairs on the upper surface of the lower lobes of the squamae. In *Hemilucilia* the vibrissae are on a level with the oral margin, while in *Chloroprocta* the vibrissae are placed above the oral margin by the length of the second antennal segment.

Characters exhibited in the male terminalia of the higher Diptera afford a positive and ready means of identifying the males of most of the species. This is particularly advantageous to the field entomologist who may not be familiar with the chaetotaxic and morphological characters usually employed in the classification of these groups and who is often confused by the similarity of form and coloration in several species belonging to different genera.

By the use of the above external morphological characters and the examination of the parts of the male terminalia illustrated herein, the species occurring in North America can be easily and accurately determined.

Cochliomyia americana is the only species discussed in this paper known to be parasitic. *Cochliomyia macellaria* is a saprophyte and is definitely known to breed principally in carcasses, but the larvae may be found as secondary invaders

of wounds of man or animals. It is indicated, from the meager available information, that the other species are necrobiotic and that the larvae might occur at times in suppurative lesions of man and animals.

Synonymy of names is not discussed herein. So much confusion exists regarding the proper names to be used for these species that a correct synoptic list is impossible at the present time. The illustrations of the male terminalia given herewith were drawn from type specimens where possible, or from specimens in the National Collection which were determined by C. H. T. Townsend or the late J. M. Aldrich.

The genus *Cochliomyia* Tns. is represented by but four species, namely, *C. americana* C. & P., *C. macellaria* F., *C. laniaria* Wied., and *C. minima* Shann. The last-named species has not been collected in the United States. *C. americana* and *C. macellaria* are common species; the former is the only species of the genus known to be of any great economic importance. Little is known of the habits or relative abundance of *laniaria* or *minima*. They are either highly specific parasites on hosts not yet determined, or they represent comparatively rare transitional forms. The adults have been captured over dead mollusks. *C. laniaria* has been reported from Key West, Fla., and *C. minima* from St. Domingo, West Indies.

Males of the several species of *Cochliomyia* are easily distinguished from each other by the differences in the shape of the phallosomes (Plate I, *a*, *b*, *c*, and *d*) and the external and internal forceps (Plate I, *e*, *f*, *g*, and *h*). The phallosome (aedeagus) of *americana* (Plate 16, *a*) is quite distinct from that of the other three species of the genus and is apparently a modification of this structure from the long, more or less straight form characteristic of the genus. The parameres (anterior and posterior claspers), a small sclerite connecting the posterior paramere with the base of the phallosome (phallobase), a part heretofore undescribed in the male genitalia of North American Calliphoridae, and the extremely long phallosome readily separate *minima* (Plate 16, *c*) from the other members of the genus.

The phallosomes of *laniaria* and *macellaria* (Plate 16, *d*, and *b* respectively) are quite similar, but the more tapering distal end of the phallosome of the former distinguishes it from the latter.

The exceedingly long external and internal forceps of *laniaria* (Plate 16, *h*) are characteristic of this species.

The writers were unable to find any record of any of the species of *Hemilucilia* Brauer being collected in the United States; however, *H. fuscanipennis* (Macq.) was reported from Mexico and it seems quite likely that this species may be present seasonally in Texas, New Mexico, Arizona, or California. The more important parts of the male terminalia of *H. fuscanipennis* are shown in Plate 17, *d*, *e*, and *f*.

Compsomyiops wheeleri (Hough) is the only species of this genus known to occur in the United States. This species has been reported as being quite common along the California coast from San Francisco southward. C. C. Deonier has collected many specimens in the mountains of Arizona. Recently, specimens were captured in blowfly traps at Uvalde, Tex., by A. W. Lindquist. This species bears a marked resemblance to *Cochliomyia americana* and may be easily mistaken for it if only superficially examined. The large club-shaped palpi, the dark haired, lower squamae, and the parts of the male terminalia shown in Plate 17, *a*, *b*, and *c*, quickly distinguish it from *americana*.

The species of *Chloroprocta* do not have three, distinct dark, longitudinal stripes on the dorsum of the thorax. *C. semiviridis* V. d. W. is the only species recorded in the United States. This is from Texas. The writers have identified specimens from blowfly trap collections made in the vicinity of Brownsville.

Because of their dark greenish-blue color, *C. semiviridis* might be mistaken for rubbed specimens of *Cochliomyia macellaria*, especially in large mixed collections.

The phallosome, the external and internal forceps, and the 5th sternite of *Chloroprocta semiviridis* are shown in Plate 17, *g*, *h*, and *i*, respectively.

It will be noted from Plate 17 that the phallosomes of *Hemilucilia fuscanipennis*, *Compsomyiops wheeleri*, and *Chloroprocta semiviridis* are closely similar in general appearance. *Compsomyiops wheeleri* can be distinguished from the other two species by the presence of a thumb-like process bearing a terminal bristle at the base of each posterior paramere. *Hemilucilia fuscanipennis* and *Chloroprocta semiviridis* are easily distinguished from each other by differences in the shape and size of the anterior parameres.

In order fully to facilitate field identification of these species, the following synoptic key is herewith appended:

1. Palpi short and slender .... (Cochliomyia) 2
   Palpi long and club-shaped 5
2. Basicostal scale black in female; male aedeagus as in Plate I, *a* .... *C. americana* C. & P.
   Basicostal scale whitish to yellow or yellow-orange in female; male aedeagus not as in Plate I, *a* 3
3. Thorax dark with but slight traces of metallic coloration, the longitudinal stripes on dorsum distinct, the median one continuing on to scutellum; male aedeagus as in Plate I, *d* .... *C. laniaria* Wied.
   Thorax metallic blue to bluish green; male aedeagus not as illustrated in Plate I, *d* 4
4. Fifth tergite of female reddish coppery color; male aedeagus as in Plate I, *c* .... *C. minima* Shann.

Fifth tergite of female blue to bluish-green; male aedeagus as in Plate I, *b*............*C. macellaria* (F.)

5. Epistoma short; vibrissae at or near the oral margin; male aedeagus as in Plate II, *d*............*Hemilucilia fuscanipennis* (Macq.)

Epistoma elongate; vibrissae above the oral margin by the length of the second antennal segment............6

6. Thorax with apparent longitudinal stripes on dorsum; squamae dark haired anterior to and on depression above; male aedeagus as in Plate II, *a*............*Compsomyiops wheeleri* (Hough)

Thorax without apparent longitudinal stripes on dorsum; squamae without hair above; male aedaegus as in Plate II, *g*............*Chloroprocta semiviridis* V. d. W.

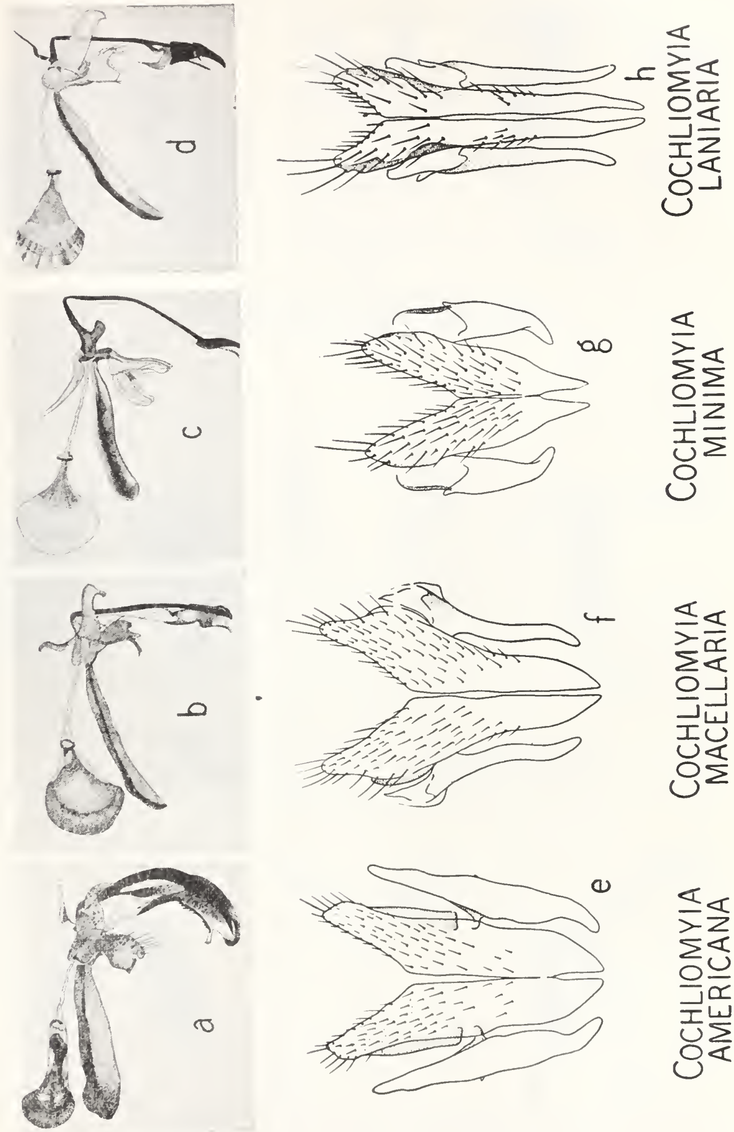
Explanation of Plates.

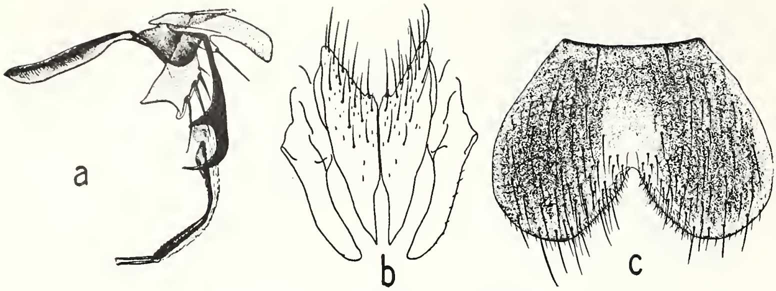
Plate 16.

a. Phallosome of *Cochliomyia americana* C. & P.
b. Phallosome of *Cochliomyia macellaria* F.
c. Phallosome of *Cochliomyia minima* Shann.
d. Phallosome of *Cochliomyia laniaria* Wied.
e. Internal and external forceps of *Cochliomyia americana* C. & P.
f. Internal and external forceps of *Cochliomyia macellaria* F.
g. Internal and external forceps of *Cochliomyia minima* Shann.
h. Internal and external forceps of *Cochliomyia laniaria* Wied.

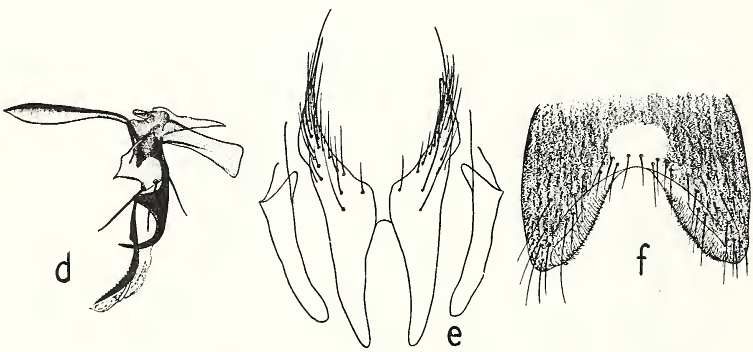
Plate 17.

a. Phallosome of *Compsomyiops wheeleri* (Hough)
b. Internal and external forceps of *Compsomyiops wheeleri* (Hough)
c. Fifth sternite of *Compsomyiops wheeleri* (Hough)
d. Phallosome of *Hemilucilia fuscanipennis* (Macq.)
e. Internal and external forceps of *Hemilucilia fuscanipennis* (Macq.)
f. Fifth sternite of *Hemilucilia fuscanipennis* (Macq.)
g. Phallosome of *Chloroprocta semiviridis* V. d. W.
h. Internal and external forceps of *Chloroprocta semiviridis* V. d. W.
i. Fifth Sternite of *Chloroprocta semiviridis* V. d. W.

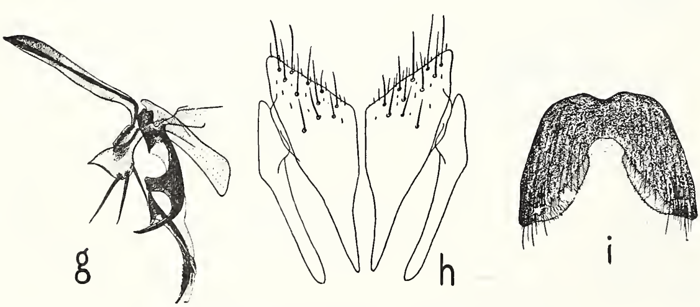

a
b
c
d
e
f
g
h
Cochliomyia americana
Cochliomyia macellaria
Cochliomyia minima
Cochliomyia laniaria



COMPSOMYIOPS WHEELERI



HEMILUCILIA FUSCANIPENNIS



CHLOROPROCTA SEMIVIRIDIS

ATTRACTION OF EUXESTA NOTATA WIED. (DIPTERA: ORTALIDAE) TO ROASTED COFFEE.

By W. R. Walton,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

The ortalid fly *Euxesta notata* Wied. is a common, small metallic-greenish species known to be distributed throughout the Eastern States from Vermont to Florida and westward to Illinois. Its wings are characterized by the presence of a triangular, dusky spot on the distal end of the costal margin. The species seems to be a scavenger and is recorded as having been reared from the pulp of the fruit of Osage orange (*Maclura pomifera* Schn.), cotton bolls, sumac fruits, berries of the horse nettle (*Solanum carolinense* L.), codling moth-infested apples, and human excrement. It is frequently present on the window panes of the writer's office on the third floor of the South Building of the United States Department of Agriculture in Washington, D. C. On August 15, 1936, adult specimens of this fly were brought him by H. A. Lepper, a chemist engaged in testing roasted, freshly ground coffee for the Food and Drug Administration in an adjoining corridor of the same building. Mr. Lepper stated that these flies were often numerous on the coffee samples and were more or less of a nuisance. They were attracted both to the dry coffee and to its infusion, while these were exposed in open beakers. A few days later, at Mr. Lepper's invitation, the writer witnessed the behavior of the fly in this relation. About a dozen beakers containing either finely ground coffee or its infusion stood upon a table near an open window that looked upon an interior court paved with concrete and entirely bare of vegetation. Several adults of *Euxesta notata*, apparently all females, were running over the vessels with wings extended at right angles in characteristic ortalid style. Frequently the flies would enter a beaker and quickly extend the comparatively long ovipositor and thrust it into the ground coffee or into the band of foamy material gathered at the surface of the coffee infusion. One fly was observed to exsert her ovipositor on the surface of a beaker and to deposit something thereon. A subsequent microscopic examination failed to discover anything but a clear viscid liquid in this deposit. The flies made no attempt to feed upon the coffee, and apparently their actions were due to excitation of reproductive function through chemotaxy. There are no osage orange trees in this neighborhood and the few shade trees of the neighborhood are mainly sycamores (*Platanus*) and oaks. In the spring of 1937 the flies reappeared in numbers during the last week in May.

MINUTES OF THE 483d REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

The 483d regular meeting of the Society was held at 8 P. M., Thursday, May 6, 1937, in Room 43 of the Natural History Building of the National Museum. Thirty-two members and fourteen visitors were present, with N. E. McIndoo presiding. The minutes of the previous meeting were read and approved.

The chair brought to the attention of the Society the recent deaths of two members of the Society, W. M. Wheeler and G. F. White. Harold Morrison and H. G. Barber were appointed to draw up an obituary notice for Dr. Wheeler, and F. C. Bishopp and C. E. Burnside were asked to prepare one concerning Dr. White.

May 27 was announced by the chair as the date for the next meeting, to be held at Beltsville in commemoration of the eightieth anniverszry of Dr. O. O. Howard. After discussion, the Society voted to advance the sum of five dollars toward the expense of the refreshments.

The first paper on the regular program. by Dr. R. E. Blackwelder, was entitled "Collecting Staphylinidae in the West Indies."

> [An outline of a 21-month trip through the West Indies as Walter Rathbone Bacon Scholar of the Smithsonian Institution.
>
> [The purpose of the trip was to collect material for a revisional study of the staphylinid beetles of the West Indies. The following islands were visited: Jamaica, Hispaniola (Haiti and Dominican Republic), Puerto Rico, St. Thomas, St. Croix, St. Kitts, Antigua, Montserrat, Guadeloupe, Dominica, St. Lucia, Barbados, St. Vincent, Carriacou of the Grenadines, Grenada, Tobago, and Trinidad. One month per island was the planned stay, but this was lengthened to two months on St. Lucia, Dominica, and Antigua, and second stops of a month were made on Puerto Rico and Jamaica. Tobago and Carriacou were visited for only one day each, but yielded several hundred specimens apiece. The expedition consisted of Dr. and Mrs. Blackwelder, and was joined by Dr. Chapin for the final five weeks on Jamaica. A motorcycle was taken for transportation on each island and proved entirely satisfactory and indispensable. Staphylinids were collected in various situations, including: Termite nests, cacao pods, dung, fungus, beaches, flying, streams, bark, beating, sifting, etc. About 16 entomologists were met on the various islands, but practically no collectors were found who might furnish material to specialists. The collections are not yet completely mounted, so no systematic results are yet available, but the numerical results were given as follows: 45,000 staphylinids collected and 10,000 other beetles; at least 600 island records of staphylinids are expected to result, whereas only 135 have been previously recorded. — Author's abstract.]

Discussion by Clark, McIndoo and Leonard followed.

Dr. E. A. Chapin gave the second paper, entitled "A Collecting Trip to Jamaica.

> [About five weeks, including the last few days of January and the first week of March, were spent on the Island of Jamaica for the purpose of collecting insects for the U. S. National Museum. Special emphasis was placed upon the coleopterous families of Scarabaeidae and Staphylinidae. Dr. R. E. Blackwelder, already nearly two years in the West Indies, was on the Island and had made all preliminary arrangements for the work. It was decided because of the inadequate transportation facilities offered

by steam trains and busses, that a car should be hired for the duration of our stay. At the end of the trip this decision was shown to have been correct, as our mileage costs ran less than half the cost of cars hired by the day, and the itinerary reached many points that would otherwise have been inaccessible.

[Usual methods of collecting did not yield much material, probably because the trip was made at the height of their winter season. The nights were cool, very little came to light and there seemed a paucity of specimens under logs, beneath bark and stones; the great family Chrysomelidae was not in evidence in most parts of the Island and there were few longicornes and weevils. The May beetle group was just beginning to fly and three reasonably large collections of these were made.

[By far the greater number of specimens were taken in the net which was built on the top of the car and which was put in operation just before sun-down. The net was emptied for each change of habitat, or in the case of a long trip through similar territory, about every ten miles. In the case of delicate insects the breakage was very bad, but most of the beetles came through in good condition and many more species than have been listed as occurring on Jamaica were taken.

[As a sample of the net catches, the material taken on the road from Spanish Town to Half-way Tree on February 2, has been analyzed: 34 families of Coleoptera, representing about 150 species and about 4000 individuals were taken. Specimens damaged too badly to be of any use had been discarded before the count was made. As the net was used almost every day, a very fair sample of the species which fly at dusk was taken for the entire Island. A rough count indicates that about 50,000 specimens, nearly half of which belong to the family Staphylinidae, will be added to the Museum's collections from this trip.—Author's abstract.]

Discussed by Ewing, McIndoo, Muesebeck and Leonard.

Upon invitation from the chair the following introduced themselves: Richard Dow, Boston, Mass.; M. D. Leonard, Ithaca, N. Y.; Lawrence W. Saylor from California; and Harold S. Peters, Bureau of Biological Survey.

Adjournment followed at 9.40 P. M.

CATHERINE FORD,
Recording Secretary.

MINUTES OF THE 484th REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

The 484th meeting of the Society, celebrating the eightieth birthday anniversary of Dr. L. O. Howard, was held at the Beltsville, Md., Laboratory of the Bureau of Entomology and Plant Quarantine, on Thursday, May 27, 1937. Approximately one hundred members and visitors were present for the meeting and the picnic supper preceding, and pronounced it a most enjoyable occasion in spite of the confusion caused by thunderstorms which prevented showing of the sound movie of the periodical cicada.

Speakers for the evening, who told of Dr. Howard's many achievements and remarked on their associations with him, were Lee A. Strong, A. K. Fisher, Vernon Bailey and F. C. Bishopp. Dr. Howard was presented with a bronze study lamp, and his daughter, Miss Lucy K. Howard with some flowers, by N. E. McIndoo on behalf of the Society.

CATHERINE FORD,
Recording Secretary.

THE

ENTOMOLOGICAL SOCIETY
OF WASHINGTON

ORGANIZED MARCH 12, 1884.

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PROCEEDINGS OF THE

Entomological Society of Washington

VOL. 39 NOVEMBER, 1937 No. 8

THE INCREASING IMPORTANCE OF THE COCKROACH, SUPELLA SUPELLECTILIUM SERV., AS A PEST IN THE UNITED STATES.

By E. A. Back,

Division of Insects Affecting Man and Animals, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

Discussions of cockroaches as pests of buildings in the United States usually include references to but four species: the American cockroach (*Periplaneta americana* L.; the Australian cockroach (*Periplaneta australasiae* Fab.); the oriental cockroach (*Blatta orientalis* L.), and the croton bug or German cockroach (*Blattella germanica* L.). While no state or federal publication discussing cockroach control, aside from Leaflet No. 144 (1) of the federal Bureau of Entomology and Plant Quarantine, has mentioned *Supella supellectilium* Serville, this cosmopolitan cockroach of tropical countries seems now so definitely established in cities in the United States that it can no longer be omitted from our economic literature dealing with cockroach control.

Referred to in various places as the tropical, the subtropical, the spotted, or the brown-banded cockroach, this species of *Supella* has been recorded (2, 3, 5) as being present in 1903 in the United States only at Key West and Miami, Florida. It undoubtedly was carried to Florida from Cuba where, according to Saussure (6) it was very common in 1864. It was described as a new species by J. G. Serville (7) in 1839.

The only published account of this *Supella* being troublesome in a private home in the United States is by Whelan (8), who records its presence in 1929 in Nebraska. An examination of the Indices of the Review of Applied Entomology from the year 1913 to 1935 yields no reference to *Supella* except that of Whelan. The same is true of the files of the Federal Insect Pest Survey. Hebard (4), in 1934, recorded a single specimen taken in a house in Urbana, Ill., but considered it an adventive and not a species likely to continue to thrive in a place so far north from the tropics.

It is quite possible that *Supella supellectilium* Serv. will not be able to maintain itself in heated buildings in the North. However, it has been found, aside from in Nebraska and in

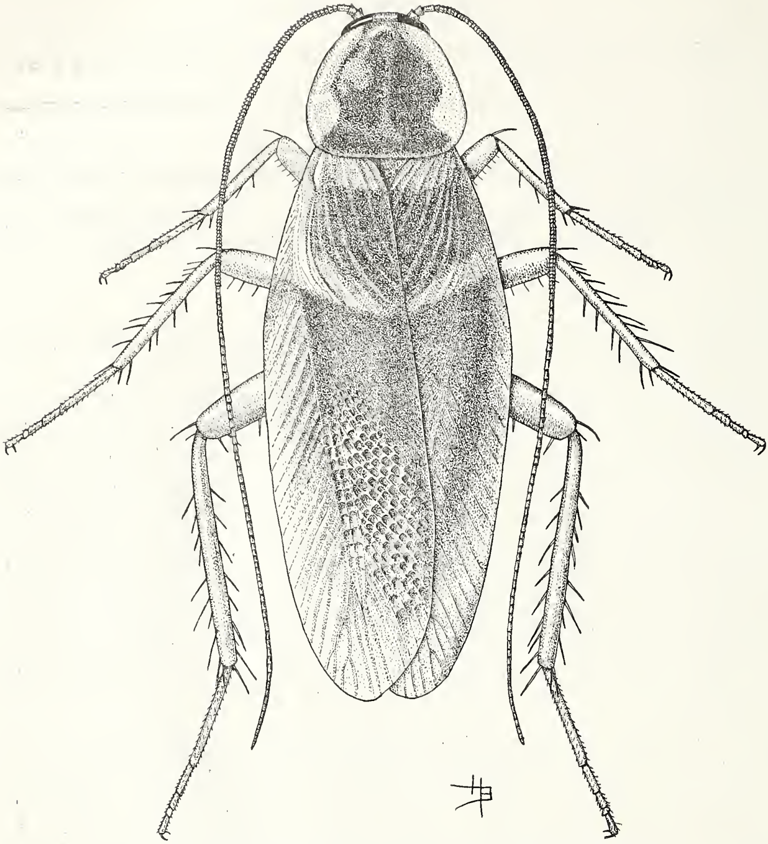

Fig. 1.—Dorsal view of male of *Supella supellectilium* Serv.

Urbana, Ill., in Chicago, Ill., and in Indianapolis, Ind. There is no question about its ability to maintain itself and to become a nuisance in the more southern cities of the United States, and the purpose of this article is to call attention to its increasing importance as a pest that entomologists and insect pest control operators may take a greater interest in examining cockroach specimens and report this species wherever it is found.

To date, *Supella supellectilium* has been taken in Key West (1903), Miami (1903), Daytona Beach (1936) and Jacksonville (1936), Florida; Savannah (1936) and Atlanta (1932–37), Georgia; Auburn (1934) and Birmingham (1936) Alabama; Cleveland (1937, A. B. Gurney), Miss.; Shreveport (1935), Louisiana; Austin (1931), Dallas (1937)), Houston (1937), San Angelo (1931–37) and San Antonio (1927), Texas; Kansas City

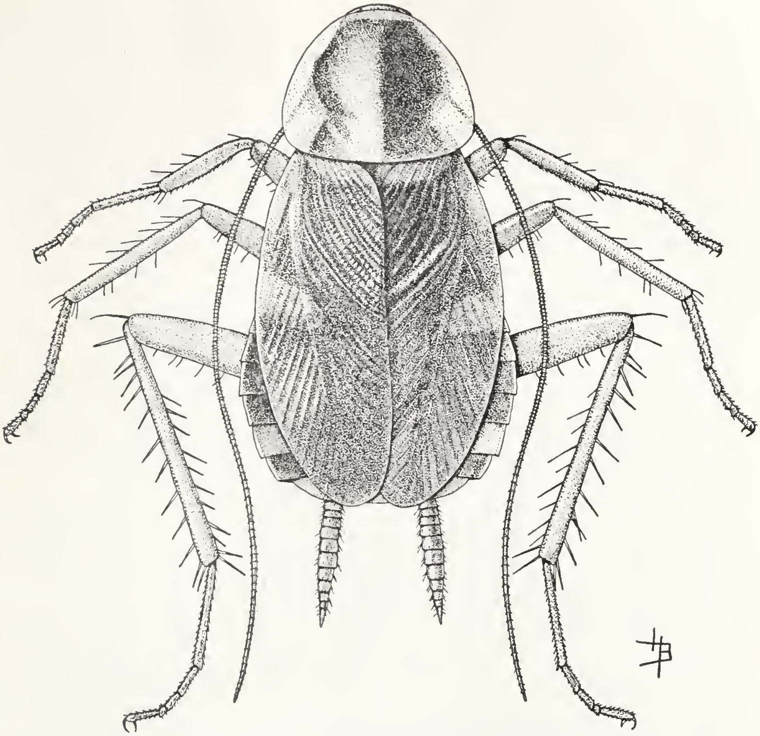

Fig. 2.—Dorsal view of female of *Supella supellectilium* Serv.

(1937), Missouri; Ada (1937, Tulsa (1937) and Oklahoma City (1937), Oklahoma; Nebraska (1929); Urbana (1933) and Chicago (1937), Illinois; and Indianapolis (1937), Indiana. Mr. G. H. Burnett of the Getz Exterminators, Inc., a firm of insect pest control operators, with agencies in numerous southern cities, furnished in February, 1937, the Bureau of Entomology and Plant Quarantine with a list of hotels, hospitals, apartment houses and private homes in Atlanta, Savannah, Jacksonville and Birmingham in which his company had conducted control operations against *Supella*, in some instances for as long as five years.

Supella supellectilium Serv. is often associated with the croton bug, *Blattella germanica* L., the only American cockroach of economic importance with which it might be confused, for it seldom exceeds nine-sixteenths of an inch in length. However, the two species, while resembling each other in size, are easily distinguished. There is a greater dissimilarity in form between the male (Fig. 1) and the female (Fig. 2) of *Supella*,

than between the sexes of the croton bug. While the mature croton bug has two dark stripes running lengthwise along the pronotum (Pl. 18), these stripes are lacking on the evenly blackish pronotum of *Supella*. While the wings of the croton bug are a uniformly pale uninteresting brown, those of *Supella* have the appearance of being twice banded with brownish-yellow due to a band extending across the base of the wings and a second band farther back, often continuous across the wings in the male (Fig. 1) but in the female (Fig. 2) interrupted due to the reduction of the bands to spots more nearly confined to the frontal margin of the wings. The well-grown nymph of *Supella* is a striking creature with its shiny blackish pronotum, the bands of white or yellowish-white across the mesonotum and metanotum, respectively (Plate 19, bottom, right), and the reddish-yellow dorsum of the abdomen enlivened by black color at the base and anterior lateral corners. The well-grown nymph of the croton bug has no cross bands upon its thorax but possesses a dull lighter band extending along the center of the back, from the head usually to the posterior end of the body.

The ootheca, or egg capsule, of *Blattella germanica* L. (Plate 18, Fig. 2) is one-quarter to three-eighths of an inch long by one-eighth of an inch wide, may contain about 40 eggs, and is transparent cellophane-like in appearance after the eggs have hatched. The ootheca of *Supella supellectilium* Serv. (Plate 19, Fig. 2) are smaller, about three-sixteenths of an inch long by three thirty-seconds of an inch wide, are plumper, contain about half as many eggs, are chitinous and are yellowish to reddish brown, a color they retain after the eggs have hatched. Furthermore, the ootheca of *B. germanica* L. is extruded so that the opening is to the left as one looks down upon the insect from above (Plate 19, bottom, left) and the eggs as carried by the female are held parallel with the surface upon which she moves. The ootheca of *Supella supellectilium* Serv. is extruded so that the eggs are held perpendicular to the surface upon which the female travels and the opening is along the upper edge.

Supella supellectilium Serv. varies greatly in the intensity of coloring. Some specimens may be decidedly black, while others are almost pale golden. The bands upon the wings may vary in intensity and extent, yet they are present and form a striking feature of the insect's coloration. Because of this intensification and recession of color the insect has been described under numerous names. According to Hobard (3) *Supella supellectilium* has the following synonomy: *Blatta cubensis*, *capensis*, *phalerata* of Saussure; *Blatta incisa*, *extenuata*, *subsastiata*, *transversalis*, *figurata* and *Ischnoptera quadriplaga* of Walker; and *Phlodromia delta* of Kirby.

Supella supellectilium Serv. is often spoken of by correspondents as congregating in furniture, in corners of rooms, in

lockers, while others complain of its presence about foods in pantries and kitchens. Phosphorus pastes have proved a satisfactory control.

It would seem that the increased travel, particularly by autoists who carry luggage to more northern points after winter sojourns in southern Florida, is responsible for the apparently recent and wide distribution of *Supella*. It is hoped that entomologists and pest control operators discovering this cockroach will report it to the Insect Pest Survey, Bureau of Entomology and Plant Quarantine, Washington, D. C.

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Explanation of Illustrations.

Plate 18, Fig. 1.—Dorsal view of *Blattella germanica* L. showing longitudinal dark stripes on pronotum. Enlarged 4 times.

Plate 18, Fig. 2.—Ootheca of *Blattella germanica* L. Enlarged 4 times.

Plate 19, Fig. 1.—Ventral view of *Blattella germanica* L. showing manner of extruding ootheca with its opening to the right. Enlarged 4 times.

Plate 19, Fig. 2.—Ootheca of *Supella supellectilium* L. Enlarged 4 times.

Plate 19, Fig. 3.—Mature nymph of *Supella supellectilium* L. Enlarged 4 times.

A NEW SPECIES OF MACHILINUS (THYSANURA: MACHILIDAE).

By Harvey L. Sweetman,[1]

Machilinus nevadensis, sp. n.

Color: Dark, shiny gray, closely resembling that of *Lepisma saccharina* L. when freshly molted; in alcohol with scales, dark gray to brown; in alcohol denuded of scales, testaceous.

Body: Clothed with scales except styli, legs, and head appendages, which are clothed with hairs. The hairs are not shown in the illustrations. Length, about 10–11 mm. exclusive of appendages.

Head: Eyes rounded, very slightly broader than deep, touching medially for about two-thirds of the width so as to resemble a printed figure *8* in transverse outline, forming a broad obtuse angle at the dorsal angle of junction and a broad acute angle at the ventral angle of junction (Fig. A). The pigment and facets of the eyes do not extend to the margins of the head from a dorsal view. Eyes notched on the outer ventral margins (Fig. A, vn). Antennae slightly more than one-half the body length and tapering to the distal ends; scape cylindrical, slightly more than twice as long as broad, slightly tapering at the basal end, and a whorl of hairs at the distal end (Fig. B). Second segment broader than long, about one-third as long as the scape, a whorl of hairs at the distal end. Following segments bearing a whorl of hairs and alike except for the gradual reduction in diameter. More than 100 segments. Maxillary palpus seven segmented, long and attenuated; approximate ratio of length of segments: 1, 2, 1, 2, 2½, 2½, 1¼ (Fig. E). Segment I with a prominent dorso-lateral spur (Fig. E, sp), the inner margin of segment with a much shorter toothed process. Labial palpus three segmented; the distal segment the longest (Fig. D). Mandible as illustrated (Fig. C).

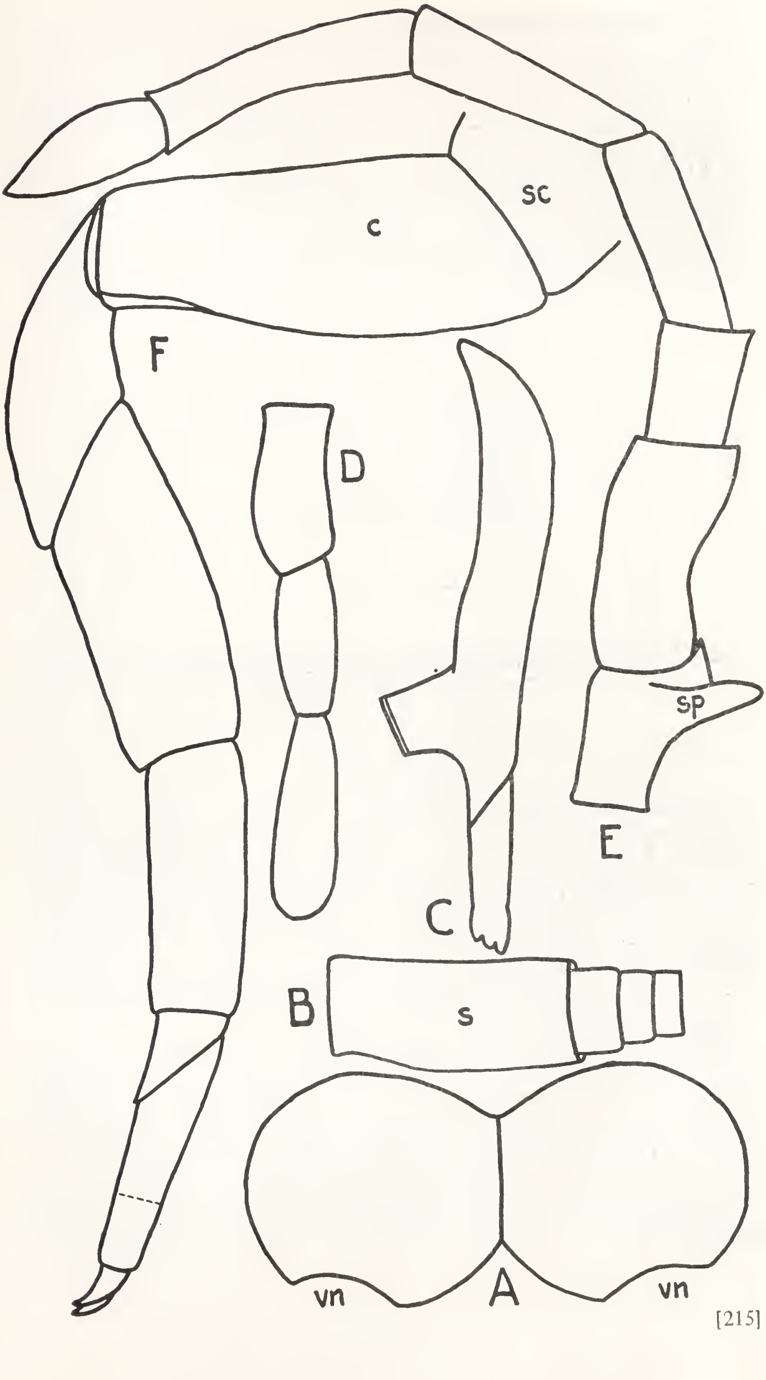
Thorax: Noticeably arched, prothorax narrower than mesothorax and metathorax. All legs similar and lacking coxal styli (Fig. F); each coxa bears four prominent hairs, two on the inner side and two on the outer side.

Abdomen: Tapering to a point at the distal end, styli on sternites II to IX. Caudal filament two and one-half times as long as lateral cerci and about three-fourths the length of the body. Cerci and caudal filament definitely and many segmented, tapering to the distal ends; the distal segments are slightly longer than the basal segments. Ovipositor two-thirds the length of the cerci.

Habitat: Nevada, Soldier Canyon near Fort Halleck (Elko). August 14, 1935. Holotype ♀. Paratopotypes 6 ♀♀.

Habits: Crawling about on the dry soil on a hot sunny afternoon, in the vicinity of ant nests and in an occupied prospector's cabin. First observed specimen bit my foot, while I was sun drying after bathing. Observed scavenging in the prospector's cabin. When disturbed either with a stick or by ants, they would throw themselves in the air, apparently by

[1] Contribution from the entomological laboratory of Massachusetts State College.


sc
c
F
D
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thrusting the caudal filament against the ground, for a distance of one to two inches. Usually remained motionless for a few seconds, then moved rapidly away for an inch or two, before resuming their normal movements. The ants showed no apparent antagonism. Individuals were observed as much as 30 to 40 feet away from ant nests.

The nearest allied species is *M. aurantiacus* (Schött) recorded from California. Readily distinguished by the darker and more uniform color as contrasted with the stripes of *aurantiacus* and the absence of the spur on the second segment of the maxillary palpus. Schött gives the length of *aurantiacus* as 7 mm.

MACHILINUS NEVADENSIS, PL. 20.

A. Compound eyes; *vn*, ventral notch.
B. Basal segments of antenna; *s*, scape.
C. Mandible.
D. Labial palpus.
E. Maxillary palpus; *sp*, spur.
F. Metathoracic leg; *sc*, subcoxa; *c*, coxa.

THE LARVA OF CHALCODERMUS COLLARIS HORN WITH KEY TO RELATED SPECIES.

By J. F. ALSTERLUND.[1]

INTRODUCTION.

Chalcodermus collaris Horn is a bronze or copper-colored snout beetle about five mm. in length, which in the vicinity of Urbana, Illinois, breeds in the seed pods of *Cassia chamaechrista* L., or partridge pea. The following descriptions of *C. collaris* are based on material gathered in the course of a life history study of this weevil made by the writer in 1933. No detailed descriptions of larvae of *Chalcodermus* have been published. The life history and brief description of the immature stages of *C. aeneus* Boh. were given by Ainslie ('10).

Material of the latter species and of *C. vittatus* Champ., used in making the accompanying larval key, were supplied through the courtesy of Doctor A. G. Böving of the United States National Museum. The writer is also indebted to Doctor Wm. P. Hayes, of the Department of Entomology, University of Illinois, for advice and help on many points.

[1] Contribution No. 189 from the Entomological Laboratories of the University of Illinois.

EXTERNAL ANATOMY OF *CHALCODERMUS COLLARIS* HORN.

Gross Anatomy: (Fig. 9) Length 4–7 mm. Head brown, hypognathous, partly covered by prothoracic tergum. Body legless, fleshy, white except for a faintly brownish area occupying most of prothoracic tergum. Body having wrinkled appearance due to division of meso- and metathorax and first seven abdominal segments by deep creases. Ten abdominal segments present, the first seven similar, the eighth and ninth smooth and flatter. Tenth small, cylindrical, bearing the anus. Prothorax and first eight abdominal segments bearing a spiracle. Setae generally constant in number and position (prothorax excepted). Setae variable in length, the longer ones often twisted spirally at apex; often broken off in great numbers on ventral surface of body.

Body Segmentation and Setation: (Fig. 9) Transverse pleats, or fleshy protuberances of constant occurrence form the basis for nomenclature (Böving, 1924) of parts of segments. These divisions best developed in first seven abdominal segments, as follows: tergal area consisting of prescutum (Psc), scutum (Sc), scutellum (Sct) and postscutellum (Psctl). Prescutum, longest, bulging, restricted to dorsum; two setae. Scutum, flatter, shorter, extending onto lateral aspect; no setae. Scutellum longer than scutum; eight setae. Scutum and scutellum fusing laterally; fused area smooth; bearing spiracle (Spi) and slightly dorsad of spiracle, one seta. Postscutellum short, forming caudal margin of segment on lateral aspect; disappears dorsally; no setae.

Pleural Area: Epipleurum (Epp) swollen, subtriangular, tapering dorsally. Two setae. Bounded ventrally by dorsoventral suture (DVS). Hypopleurum (Hy) prominently swollen, one seta. The hypopleura collectively form the crawling surface of the larva.

Sternal Area: Eusternum (Eu) forming anterior median portion. Two setae. Parasternum (Pa) subtriangular, caudolateral of eusternum. Bears group of about six setae. Poststernellum a narrow fold forming caudal margin of segment. No setae. Other segments modified as follows:

Prothorax (PRO).—Tergum of one piece, diffused with faint brown color along cephalic and ventral margins. Spiracle (Spi) in caudolateral angle. Four setae on dorsum and an inconstant group near spiracle. Epipleurum very small, no setae.

Hypopleurum typically swollen, two setae. Eusternum, parasternum, poststernellum similar to first abdominal segments.

Meso- and Metathorax (MESO, META)—Tergum of each consisting of two pleats, prescutum (Psc) and scutumscutellum

(Sc-Sct). Prescutum anterior, bulging, restricted to dorsum, two setae. Scutum-scutellum flatter, extending onto lateral aspect. Bearing single row of ten setae extending onto lateral aspect.

Epipleurum, hypopleurum and sternal areas similar to first seven abdominal segments.

Eighth abdominal segment.—Tergum without pleats, sunken at caudal end. Row of eight setae on caudal margin. Spiracle present. Epipleurum and hypopleurum similar to preceding segments. Parasternum and poststernellum absent. Sternal area with six setae. *Ninth abdominal segment*—Tergum without pleats, two setae. Epipleurum occupying entire lateral aspect, one seta. Dorsoventral suture on ventral surface. Hypopleurum apparently fused with sternum. Parasternum and poststernellum absent. No sternal setae. *Tenth abdominal segment*—Much smaller than preceding segment. Cylindrical, bearing anal opening. Lower margins of latter bordered by two intersecting sulci, giving an X-shaped crease. No setae.

Head capsule: (Figs. 1, 2) Greatest width on cephalic aspect, .9–1 mm. Distinctly narrower on lateral aspect. Epicranial stem black and roughened at base, narrowing distally to form typical white suture. At point of branching of epicranial arms (EpA) a black median carina extends onto the frons. Two prominent white streaks or epicranial bands (EpBd) present which originate near the base of the epicranial stem and extend to the antennae (Ant), merging with and blotting out the epicranial arms.

Antennae—(Fig. 10) Small, membranous, two-segmented, located at distal end of epicranial bands. Basal joint flat, level with head surface, appearing more like an articulating area; studded with several minute papillae; apical segment bullet-shaped. Ocellus (Oc) black, amorphous, close to antennae. A dark brown ring or sensory spot (Figs. 1, 2, SSp) present. Head capsule bears eight pairs of setae, constant in position.

Clypeus (Fig. 1, Clp) wider than long, basal corners rounded, the sides converging distally. A strip of darkened, thickened cuticula along the frontoclypeal articulation. No setae.

Labrum (Fig. 7, Lbr) membranous, the sides converging distally. Clypeolabral suture straight, rather faint. Dark epipharyngeal rods (EpRd) showing through. Eight pairs of stout setae present; three pairs (L1, L2, L3) well back from front margin; remaining five pairs inserted along distal margin of labrum.

Epipharynx (Fig. 8) with rods (EpRd) present, extending almost the length of epipharynx, but not exceeding it. Three pairs of short, heavy setae (Ep 1, Ep 2, Ep 3) between the rods, directed disto-mesad.

Mandibles (Fig. 1, Md, also Fig 12)—Bulbous, hollow at base, bearing two teeth or dentes (Dts) apically. Articulating surfaces consisting of a preartis (PrA), a shallow concavity, and a postartis (PtA), a rounded projection of the dorsolateral angle.

Maxillae (Fig. 4) consisting of a short fingerlike cardo (Cdo) basally and stipes (Stp). Maxilla hollow, open on ental aspect, strongly convex ectally. Apex of stipes expanded to form the malar lobe (Fig. 4, M), which bears a variable number of heavy spines (Fig. 11, MS). Maxillary palpus (MxPlp) two-segmented. Palpus inserted at distal end of stipes, laterad of apex of malar lobe. Stipes bearing three setae. Two of these located on a whitened area (Fig. 4, WA) at base of palpus.

Labium (Fig. 3) consisting of a chitinized, three-branched fork or labial trident (LT). Stem of the trident lying free in the fleshy venter of head. Middle fork of trident fading out distally. Fleshy discal area of trident bearing two large setae; also two pairs of small spinules (Spn) near distal margin. Palpi (Lb Plp) two-jointed, inserted on the fleshy discal area, near lateral branches of the trident.

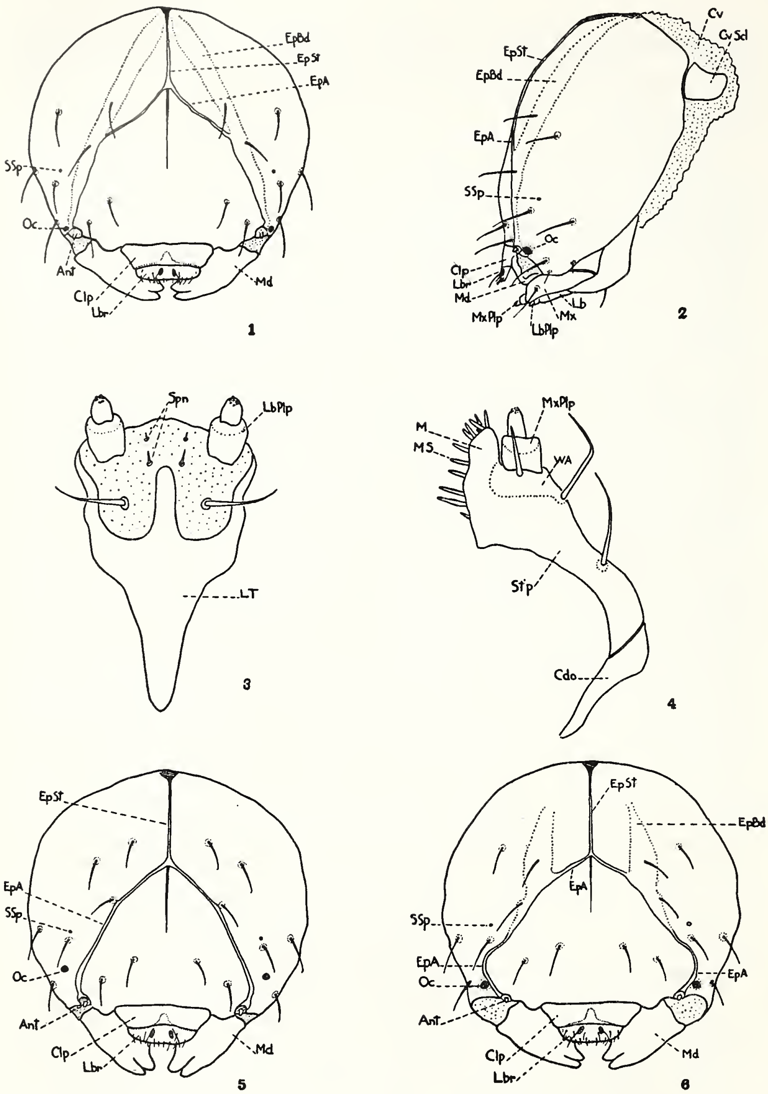
Cervical sclerite (Fig. 2, Cv Scl)—A subquadrate cervical sclerite present in cervicum (Cv), fitting close against caudal margin of head capsule, normally hidden by overlapping tergum of prothorax.

Spiracles (Fig. 13)—Prothoracic and abdominal spiracles similar in structure, former slightly larger. Spiracle consisting of a rounded plate, and pair of coils or air tubes (AT) directed dorso-caudad. Atrium (Atr) located at juncture of plate and air tubes.

KEY[2] TO THE KNOWN LARVAE OF *Chalcodermus* Schon.

1. Head with epicranial arms (Fig. 5 EpA) distinct, rest of head uniform brown in color .... *vittatus* Champ.
1– Head with two white bands (Figs. 1, 6, EpBd), marking the adfrontal sutures, which fuse with the epicranial arms (EpA)........................ 2
2. White bands strongly diagonal, meeting on top of head to form an inverted v; after joining with the epicranial arms, obscuring the latter clear to the antennae (Fig. 1, Ant) .... *collaris* Horn
2– White bands parallel, fading out toward top of head; anterior ends of the bands merely reaching the epicranial arms, the latter distinct from the juncture to antennae (Fig. 6) .... *aeneus* Boh.

[2] The writer wishes to acknowledge the help of Mr. T. L. Bissel in correction of this key.


EpBd
EpSt
EpA
SSp
Oc
Ant
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1
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Spn
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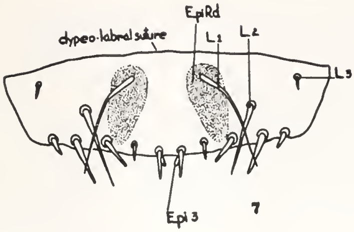

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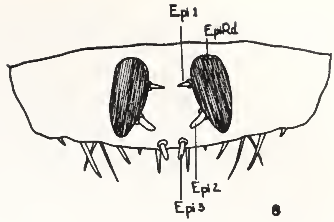

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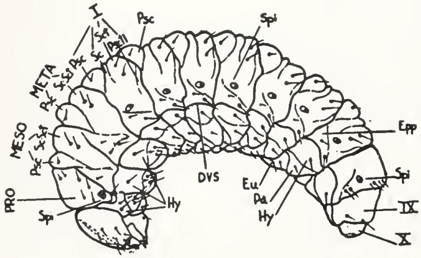

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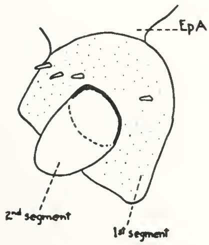

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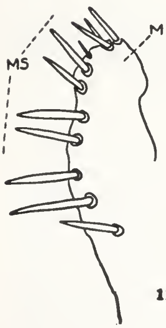

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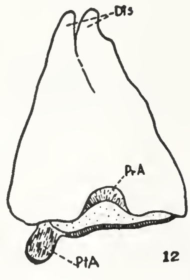

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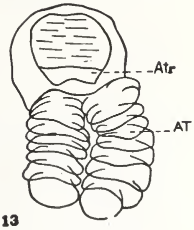

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Explanation of Figures.

Plate 21.

Fig. 1—*C. collaris*, cephalic aspect of head.
Fig. 2—*C. collaris*, lateral aspect of head.
Fig. 3—*C. collaris*, ectal aspect of labium.
Fig. 4—*C. collaris*, ectal aspect of maxilla.
Fig. 5—*C. vittatus*, cephalic aspect of head.
Fig. 6—*C. aeneus*, cephalic aspect of head.

Plate 22.

Fig. 7—*C. collaris*, labrum.
Fig. 8—*C. collaris*, epipharynx.
Fig. 9—*C. collaris*, lateral aspect.
Fig. 10—*C. collaris*, antenna.
Fig. 11—*C. collaris*, malar lobe.
Fig. 12—*C. collaris*, mandible.
Fig. 13—*C. collaris*, abdominal spiracle.

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A NEW SPECIES OF PANORPA FROM UTAH, WITH NOTES ON OTHER NEARCTIC SPECIES (MECOPTERA).

By Ashley Buell Gurney

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

A collection of insects recently submitted for identification by Dr. George F. Knowlton, of the Utah Agricultural Experiment Station, includes two species of *Panorpa*, one of which is well known and widely distributed; the other, represented by six specimens, is new. Until Carpenter (1935, p. 106) reported *P. lugubris* Swederus from New Mexico, with some doubt regarding the data, the western limits of the genus *Panorpa* in the United States and Canada were Winnipeg, Manitoba, eastern Kansas, and Austin, Tex. Accordingly, records of two species of the genus from northeastern Utah are of unusual interest. The present paper also includes notes on another

species and a summary of recent literature concerning Nearctic Mecoptera.

Panorpa utahensis, new species.

(Pl. 23, Figs. 1–6).

Male.—Size medium; wing pattern and body markings rather pale; wings exceeding abdomen.

Venation of fore wing as illustrated (Fig. 1); sixth abdominal segment without anal horn; ventral view of genital bulb as illustrated (Fig. 3); ventral valves curved, filamentous and brush-like at tips; internal structure well sclerotized and conspicuous; attachment of hypovalvae to hypandrium as in Fig. 4; dorsal view (with forceps omitted) as in Fig. 5; preepiproct with paired lobes and cerci; a membranous tongue, associated with the anus, projecting from beneath the preepiproct.

Female.—Dorsal view of subgenital plate (ninth sternite) as illustrated (Fig. 2), broadly emarginate at base, a supporting membrane upon the subgenital plate (as stippled in the figure) composed of side pieces and paired lobes at the base; internal skeleton (Fig. 6) supported upon membrane of subgenital plate by attachments at base and paired muscular connections to dorsal portion of ninth segment; central area of skeleton (stippled in figure) scarcely sclerotized; heavily sclerotized central structures on ventral surface with thin-walled tube leading from them.

Coloration.—Head yellow to pale brown; ocelli pale, surrounded by dark brown; antennae dark brown to black, first and second segments yellow; maxillary and labial palpi pale, tips black; thorax pale gray, dark brown at wing bases, a black spot at base of each coxa and at dorso-caudal angle of meso- and metepimeron; legs pale, spines black, apical tibial spurs pale to light brown; wing membrane colorless, brown pattern as in Fig 1, intensity of color weak to medium, a few cross-veins weakly margined. Some variation is shown in the wing pattern of the different specimens, as for example in the exact area covered by the apical band and the first basal spot. Abdomen pale, segments 1–5 dark brown dorsally.

Measurements.—Length of fore wing 11 mm. in male, 12 mm. in female; width of fore wing, male 2.8–3 mm., female 3 mm.

Type locality.—Uintah Canyon, Utah.

Type.—No. 52215 U. S. National Museum.

The male holotype was collected August 5, 1935. The allotype was taken at Whiterocks, Utah, August 6, 1935. Of the four paratypes, two females and one male are from the type locality, August 5 and 6, 1935, and a male with genitalia missing is from Vernal, Utah, July 1, 1935. All the material was collected by F. C. Harmston. Two paratypes, male and female, are returned to Dr. Knowlton.

The present species falls in the Nebulosa Group of *Panorpa*. The male genitalia are much like those of *P. submaculosa* Carp., but differ in the ventral valves, the internal structure of the bulb, and the proportions at the attachment of the hypovalvae to the hypandrium. The internal skeleton of the female

genitalia is most like that of *P. maculosa* Hagan, from which it differs in the constricted base and the form of the apical lobes.

Panorpa venosa Westwood.

(Pl. 23, Fig. 7.)

Panorpa venosa Westwood, Trans. Ent. Soc. London, Vol. 4, p. 190, 1846.

Uintah Canyon, Utah—One male collected August 6, 1935, by F. C. Harmston (U. S. National Museum Collection).

This species has been known previously from Massachusetts and South Carolina west to Manitoba and Iowa (Carpenter, 1931 b, p. 235, 1936) and has been called "the most widely distributed of all the American Panorpas." The specimen here recorded agrees in both wing pattern and genitalia with specimens from the vicinity of Washington, D. C. In all of the males now available each ventral valve is composed of the following two parts: A brush-like basal filament, and a smooth, flattened, slightly curved apical portion which appears to rise from about the middle of the basal filament. The apical portions of the ventral valves are absent in Carpenter's figure (1931 b, Fig. 16), so Fig. 7 is given, as drawn from an alcoholic specimen. The apical flaps of the internal structure of the genital bulb are membranous and subject to shriveling in dried material, but the other features remain suitable for study; the whole is illustrated here for the sake of completeness.

Panorpa longicornis Carpenter.

Panorpa longicornis Carpenter, Bull. Mus. Comp. Zool., Vol. 72, No. 6, pp. 231–233, Figs. 12, 49, 1931.

White Top Mt., Grayson Co., Va.—One male collected July 10, 1936, and one female July 15, 1936, by Austin H. Clark (U. S. National Museum Collection).

Although numerous specimens are known from Tennessee and North Carolina, these are the first records from Virginia, as well as the first collections made during the month of July. The genitalia of both sexes agree with the figures given by Carpenter, but the design of the wing spots varies somewhat from that indicated in the original description, being very like that of *Panorpa signifer* Banks, as represented by available specimens and the illustration given by Carpenter (1931 b, Fig. 81). This is in keeping with the variation in wing pattern exhibited by various species of *Panorpa*.

In studying the female genitalia of *Panorpa*, the suggestions of Carpenter (1931 b, p. 219) have been followed. It is necessary to work very carefully because when examining a female of

unknown species the exact nature of the internal skeleton can not be anticipated and injury may easily result. The morphology of the genitalia has been discussed by several writers, and recently by Snodgrass (1935, pp. 599–600, Fig. 306, A–D) for the male and by Issiki (1933, pp. 319–342, Figs. 1–16) for both sexes.

It seems worth while, for the benefit of other students, to summarize the important taxonomic literature of Nearctic Mecoptera that has appeared since Carpenter's excellent revision of 1931. The papers on fossils have been omitted.

Carpenter, Frank M.

1931a. The biology of the Mecoptera. Psyche, Vol. 38, No. 1, pp. 41–55, fig. 1.

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1931b. Revision of the Nearctic Mecoptera. Bull. Mus. Comp. Zool., Vol. 72, No. 6, pp. 205–277, text figs. 1–6, figs. 1–90.

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1932a. Additional notes on Nearctic Mecoptera. Bull. Brooklyn Ent. Soc., Vol. 27, pp. 149–151.

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1932b. Note on *Haplodictyus incertus* Navas. Psyche, Vol. 39, No. 4, p. 144.

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1933. A new Boreus from British Columbia (Mecoptera). Canad. Ent., Vol. 65, No. 4, pp. 94–95, figs A and B.

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1935. New Nearctic Mecoptera, with notes on other species. Psyche, Vol. 42, No. 2, pp. 105–122, figs. 1–15.

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1936. Descriptions and records of Nearctic Mecoptera. Psyche, Vol. 43, Nos 2–3, pp. 56–64, figs. 1–3.

Issiki, S.

1933. Morphological studies on the Panorpidae of Japan and adjoining countries and comparison with American and European forms. Jap. Jour. Zool., Vol. 4, No. 4, pp. 315–416, figs. 1–45.

Lloyd, L. C.

1934. Two species of Mecoptera from Alaska. Pan-Pac. Ent., Vol. 10, No. 3, pp. 119–120, figs. 1–3.

Setty, Laurel R.

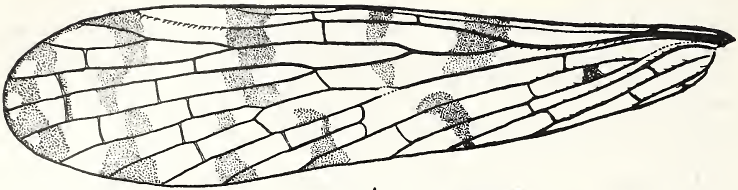
1931. The biology of *Bittacus stigmaterus* Say (Mecoptera, Bittacusidae). Ann. Ent. Soc. Amer., Vol. 24, No. 3, pp. 467–484, figs. 1–11.

Smith, Roger C.

1934. Notes on the Neuroptera and Mecoptera of Kansas, with keys for the identification of species. Jour. Kans. Ent. Soc., Vol. 7, No. 4, pp. 120–145, figs. 1–11.

Snodgrass, R. E.

1935. Principles of Insect Morphology, McGraw-Hill, New York, pp. 1–667, figs. 1–319.



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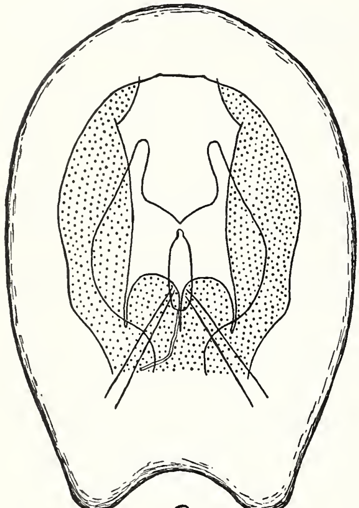

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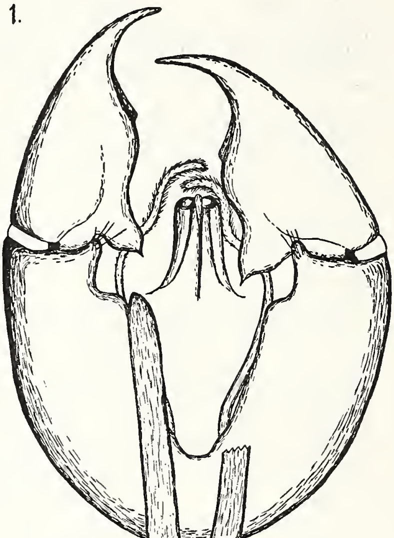

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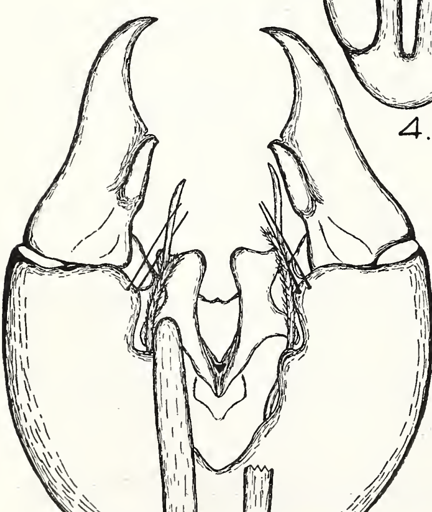

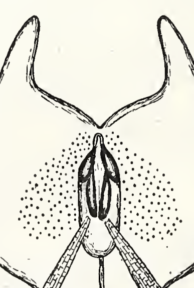

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Tillyard, R. J.
1935. The evolution of the scorpion-flies and their derivatives (Order Mecoptera). Ann. Ent. Soc. Amer., Vol. 28, No. 1, pp. 1–45, 24 figs., 2 pls.

Williams, F. X.
1916. The pupa of *Boreus brumalis* Fitch. Psyche, Vol. 23, No. 2, pp. 36–39, fig. 1.

Explanation of Plate.

Fig. 1. *Panorpa utahensis*, new species, left front wing of male paratype.
Fig. 2. Same, dorsal view of subgenital plate of allotype.
Fig. 3. Same, ventral view of genital bulb of holotype.
Fig. 4. Same, attachment of hypovalvae to the hypandrium of holotype.
Fig. 5. Same, dorsal view of preepiproct and associated structures (forceps omitted) of holotype.
Fig. 6. Same, dorsal view of internal skeleton of allotype.
Fig. 7. *Panorpa venosa* Westwood, ventral view of genital bulb, drawn from an alcoholic male collected in August, 1936, 19 miles north of Washington, D. C., by H. S. Barber.
(Figure 1 drawn by Eleanor A. Carlin, others by the author.)

A NEW CHEYLETID MITE (ACARINA) PARASITIC ON THE CAROLINA JUMPING MOUSE, ZAPUS HUDSONIUS AMERICANUS (BARTON).

By Irving Fox,
Department of Zoology and Entomology, Iowa State College, Ames, Iowa.

During the summer of 1937 the writer in company with Mr. Robert Bray and Mr. George Petrides trapped regularly around Washington, D. C., with the purpose of collecting arthropod ectoparasites of small mammals. On July 31, there was captured at Suitland, Md., a Carolina jumping mouse which, on examination, was found to be parasitized by a new species of *Myobia*. Infestation was more or less general, the mites in all stages of development occurring over the entire pelage.

I wish to express my appreciation to Dr. H. E. Ewing, of the Bureau of Entomology and Plant Quarantine, in whose honor this new species is named, for his helpful advice and encouragement while this work was in progress.

FAMILY CHEYLETIDAE.

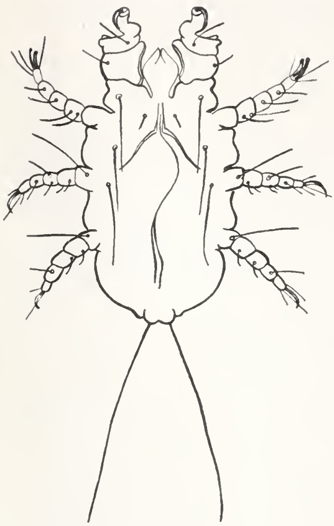
Myobia ewingi, n. sp.

Female. (Fig. 2): Total length, 0.42 mm.; width at the widest place, 0.23 mm. Dorsal setae arranged in five transverse rows, of which the first three consists of

four setae each, while the last rows consist of but two setae each. Lateral setae of row I situated at the bases of legs I and anterior to the coxae of legs II, larger than any of the other setae, being basally broad and tapering to a fine point, long, reaching beyond the bases of the lateral setae of row II by about half their length. Submedian setae of row I very small, less than half the length of the lateral setae of that row, situated much more posteriorly, short, barely reaching the bases of the submedian setae of row II. Lateral setae of row II situated posterior to legs II, long and slender, reaching beyond the bases of the lateral setae of row II by about half their length. Submedian setae of row II placed more posteriorly than the lateral setae of this row, long and slender, reaching well beyond the bases of the submedian setae of row III. Lateral setae of row III situated at the base of legs III, long and slender, reaching to the coxae of legs IV. Submedian setae of row III placed slightly anterior to the lateral setae of this row, slightly longer than the latter, reaching beyond the bases of the submedian setae of row IV by about one-third of their length. Row IV consisting of a single pair of setae, submedian in position, long and slender, reaching beyond the bases of submedian setae of row V by about one-third their length. Row V also consisting of a single submedian pair of setae situated posterior to legs IV and as long as the submedian setae of row IV. Legs I distinctly three-segmented, more than twice as long as wide. Tarsi of legs II each with two slender claws, the posterior of which is slightly shorter and more slender than the anterior. Tarsi of legs III and IV each with a single slender curved claw.

The female of this species may be distinguished from *M. affinis* Poppe, which it closely resembles by the unequal claws of the tarsi of legs II and by lacking a well-developed seta on the trochanters of legs II, III, and IV. In the above-described species the setae of the trochanters are very weak and much less developed than the body setae, rather than being strong and robust and as well developed as the body setae. From *M. musculi* (Schrank) the female of this new species is differentiated by the absence of lateral setae posterior to legs IV in row V and by the possession of two claws on the tarsi of legs II rather than but one.

Male (Fig. 1): Total length, 0.36 mm.; width at the widest place, 0.17 mm. Dorsal setae arranged in three transverse rows of which the first consists of four setae, while the last two rows consist of but two setae each. Lateral setae of row I situated at the bases of legs I and anterior to the coxae of legs II, long and slender, not different from the other lateral setae, extending beyond the bases of the lateral setae of row II. Submedian setae of row I very much reduced, situated far behind the place of origin of the lateral setae of the same row. Lateral setae of row II situated posterior to legs II, long and slender, extending beyond the bases of the lateral setae of row III. Submedian setae of row II absent. Lateral setae of row III situated at the bases of legs III, long and slender, extending well beyond the coxae of legs IV. Submedian setae of row III also absent. Legs I distinctly three-segmented, more than twice as long as wide. Tarsi of legs II each with two slender claws of which the posterior is longer than the anterior and more slender. Tarsi of legs III and IV each with a single slender curved claw. Penis long and tapering, extending to a point on the same level with the bases of legs II. For further details regarding the structure of the penis see Fig. 1.



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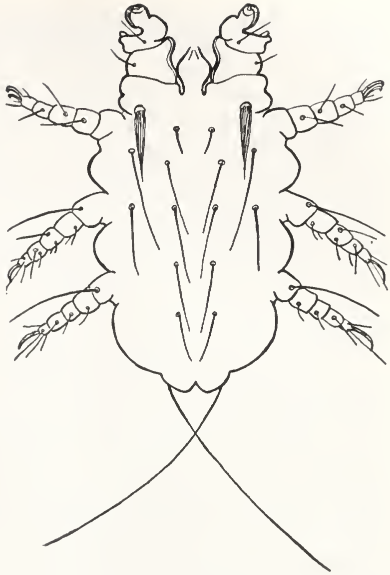

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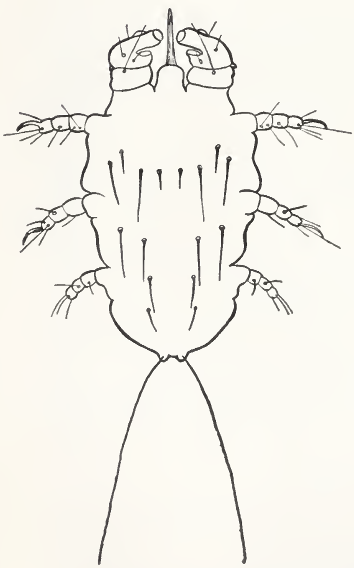

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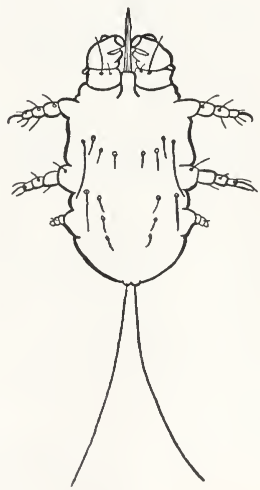

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The male of this species may readily be distinguished from that of *M. affinis* Poppe by the penis, which is much longer and more sinuous and by the reduced setae on the trochanters. From the male of *M. musculi* (Schrank) this species is differentiated by the absence of setae between the lateral setae of row II and by having two claws on the tarsi of legs II rather than one.

Protonymph (Fig. 4): Total length, 0.28 mm.; width at the widest place, 0.16 mm. Dorsal setae arranged in five transverse rows, of which the first consists of two setae, the second of six setae, and the last two of two setae each. The setae of the first row are lateral in position and situated well behind the bases of legs II, short but extending well beyond the origin of the lateral setae of row II. Lateral setae of row II situated about half way between legs II and III, long, being the longest setae on the dorsum, reaching well beyond the coxae of legs III. The lateral setae of row II are followed by two small submedian setae whose position and length are shown in Fig. 4. Lateral setae of row III situated behind legs III, long, extending to the bases of legs IV. Submedian setae of row III very small, much shorter than the lateral setae of that row, situated much more posteriorly and hardly reaching the bases of the setae of row IV. Row IV consisting of a single pair of setae submedian in position, situated on a level with legs IV, short, barely reaching the bases of the setae of row V. Row V consisting of a single submedian pair of setae situated posterior to legs IV and somewhat smaller than the setae of row IV. Legs I three-segmented, more than twice as long as wide. Legs II and III about the same lentgh, legs IV much reduced, about one-third as long as legs III. Tarsi of legs II each with one slender curved claw, tarsi of legs III and IV without any claw.

Deutonymph (Fig. 3): Total length, 0.35 mm.; width at the widest place 0.21 mm. Dorsal setae arranged as in the protonymph, more robust and better developed. Legs I twice as long as wide, three-segmented. Legs II and III about the same length, legs IV longer than in the protonymph, almost as long as legs III. Legs II and III each armed with a single slender, curved claw; legs IV without a claw.

The nymphal stages of this species are unusual in the rudimentary condition of the fourth pair of legs and in the tarsal armament.

Type host.—The Carolina jumping mouse, *Zapus hudsonius americanus* (Barton) collected at Suitland, Md., July 31, 1937, by Robert Bray, George Petrides, and Irving Fox.

Types.—Female holotype, male allotype, a protonymph and a deutonymph in the United States National Museum (U. S. N. M. Cat. No. 1279). Fourteen female paratypes, four male paratypes, three protonymphs and three deutonymphs in the writer's private collection. All the material is mounted in balsam.

EXPLANATION OF PLATE.

Fig. 1.—*Myobia ewingi*, n. sp., male, dorsal view.
Fig. 2.—*idem*, female, dorsal view.
Fig. 3.—*idem*, deutonymph, dorsal view.
Fig. 4.—*idem*, protonymph, dorsal view.

NEW SPECIES OF BUPRESTIDAE FROM JAVA. II[1] (COLEOPTERA).

By W. S. Fisher,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

Among two small collections of buprestid beetles received from Java for identification from Dr. P. van der Goot and F. C. Drescher, the following new species were found. My sincere thanks are extended to both these men for their kindness in permitting me to deposit the types of the new species in the United States National Museum collection.

Aphanisticus drescheri, new species.

Elongate, strongly narrowed posteriorly, flattened above, moderately shining, glabrous, above and beneath uniformly black, the antennae, head, and anterior part of pronotum sometimes with a distinct cupreous or aeneous reflection.

Head elongate, parallel behind the eyes, much narrower than prothorax; front broadly, deeply excavated, with the sides parallel, when viewed from above arcuately emarginate in front; surface indistinctly punctate, with two narrowly separated, deep, median foveae behind the transverse frontal ridge, and a strongly elevated, longitudinal, median carina on underside of head; eyes with the inner margins rather strongly angulate.

Pronotum broadly subcordate, nearly twice as wide as long, slightly wider at base than at apex, widest just in front of middle; sides strongly, arcuately rounded anteriorly, nearly parallel posteriorly, indistinctly crenulate; posterior angles rectangular; anterior margin deeply, broadly, arcuately emarginate; base transversely sinuate on each side, the median lobe rather strongly produced and broadly rounded; disk strongly convex at middle, broadly flattened on each side, deeply, transversely depressed along base, with a broad, deeper depression on each side toward posterior angle, and with a deep, narrow, transversely angulate groove near the anterior margin; surface feebly, densely granulose or reticulate, with a few coarse, indistinct punctures intermixed. Scutellum small, triangular.

Elytra slightly wider than pronotum at base; humeral angles obtuse; sides parallel from bases to middles, then strongly, obliquely narrowed to the tips, which are separately broadly rounded and feebly serrate; humeri rather prominent; disk slightly convex, broadly depressed on each side behind the humerus, with very shallow basal depressions; surface densely, finely granulose, with longitudinal rows of coarse, very shallow punctures, the punctures becoming obsolete toward the apices.

Body beneath finely, densely granulose, with a few coarse, shallow, inconspicuous punctures intermixed; prosternum feebly emarginate in front; tarsus reddish yellow, except the last segment, which is black; tarsal claws black; tarsal lamellae brownish white.

Length, 3.25 mm.; width, 1.06 mm.

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[1] I. Treubia, vol. 15, 1935, pp. 27–48.

Type locality.—Mid Java: Mt. Slamat, Batoerraden (Banjoemas Residency).

Type.—No. 52209, United States National Museum. Paratypes in the F. C. Drescher collection.

Described from three specimens (one type). The type and one paratype were collected at the type locality, September 1, 1932, by F. C. Drescher; and one paratype was collected at Mt. Tangkoeban Prahoe, Preanger, West Java, at an altitude of 4,000 to 5,000 feet, during August, 1934, by the same collector. The paratypes vary slightly from the type in having the pronotum broadly, triangularly flattened along the anterior margin.

This species is allied to *javanicus* Obenberger, but it differs from that species in being more slender, and in not having the pronotum transversely grooved at the middle.

Aphanisticus oreophilus, new species.

Resembles *drescheri* Fisher, but differs from it as follows: Pronotum strongly transverse, widest at middle, the sides regularly, arcuately rounded from bases to apices, the posterior angles obtusely angulate, and the surface without a distinct, transversely angulate groove near the anterior margin, and the elytra not wider than the pronotum at base.

Length, 3.5 mm.; width, 1 mm.

Type locality.—Mid Java: Mt. Slamat, Batoerraden (Banjoemas Residency).

Type.—No. 52210, United States National Museum. Paratype in the F. C. Drescher collection.

Described from two specimens (one type). The type was collected at the type locality, August 30, 1926, by F. C. Drescher, and the paratype was collected at Preanger, Djampangs, West Java, at an altitude of 2,000 feet, during January, 1935, by Mrs. E. Walsh.

Aphanisticus aeneomaculatus, new species.

Elongate, strongly flattened above, moderately shining, glabrous; above brownish black, with aeneous, cupreous, or violaceous reflections, and each elytron ornamented with a more or less distinct, irregular, transversely oblique, bronzy green fascia at middle, and an irregular, elongate spot of the same color near the apical fourth; beneath uniformly brownish black, and more shining than above.

Head elongate, slightly wider posteriorly, distinctly narrower than the prothorax; front broadly, deeply excavated between the eyes, with the sides feebly converging toward the bottom, when viewed from above, deeply, angularly emarginate; surface finely, densely granulose, with a few large, inconspicuous punctures on the occiput, two deep, narrowly separated foveae behind the

transverse frontal ridge, and a strongly elevated, longitudinal, median carina on underside of head; eyes with the inner sides abruptly margined and placed at the extreme lateral part of the excavation.

Pronotum transverse, one and one-half times as wide as long, slightly wider at base than at apex, widest at middle; sides indistinctly crenulate, regularly, arcuately rounded from apical angles to posterior angles; posterior angles obtusely angulate; anterior margin strongly, transversely sinuate; base feebly, transversely sinuate on each side, with an acutely triangular, median lobe; surface densely granulose, broadly, irregularly flattened on each side along lateral margin, deeply depressed on each side of the median elevations, narrowly, transversely depressed along base, except at median lobe, which is slightly elevated, and with a narrow, deep, transversely angular depression between the median and anterior elevations; disk strongly, irregularly elevated as follows: A transversely triangular elevation along anterior margin, with a narrow, longitudinal, median depression; two irregular, transverse, median elevations extending on each side to the lateral fourth and separated from each other by a deep, transversely oval depression. Scutellum invisible.

Elytra slightly wider than pronotum at base, subequal in width at bases and middles; humeral angles broadly rounded; sides broadly constricted in front of middles, broadly, arcuately expanded behind middles, then obliquely converging to the tips, which are separately broadly rounded or subtruncate; humeri strongly, longitudinally carinate; surface uneven, densely granulose, indistinctly, irregularly punctate, with strongly elevated, transverse rugae between the longitudinal costae on basal halves, and each elytron with rounded, longitudinal costae as follows: A median one extending from base to near apex; a subsutural costa extending from base to middle of elytron; an indistinct lateral costa parallel to the lateral margin, beginning near middle of elytron, joined to the median costa near apex, extending around tip of elytron and joined to the sutural margin, which is strongly elevated posteriorly; and an elongate elevation between the median and lateral costae just behind the middle.

Body beneath finely, densely granulose, with a few large, shallow, inconspicuous punctures intermixed; first abdominal sternite deeply, longitudinally depressed at base, strongly carinate on each side of the depression; prosternal lobe strongly elevated, deeply, transversely depressed anteriorly; mesosternum broadly, transversely depressed; tarsus reddish yellow, except last segment, which is black; tarsal claws black; tarsal lemellae yellowish white.

Length, 3.6–4 mm.; width, 1–1.2 mm.

Type locality.—Mid Java: Mt. Slamat, Batoerraden (Banjoemas Residency).

Type and paratypes.—No. 52211, United States National Museum. Paratypes in the F. C. Drescher collection.

Described from seven specimens (one type) collected during September and December, 1932, by F. C. Drescher.

This species is closely allied to *fossulipennis* Obenberger, but it differs from that species in having the elytra ornamented on the basal halves with bronzy green designs, the two transverse, median elevations on the pronotum separated by a transversely

oval depression, and the prosternal lobe abruptly declivous at the apex.

Agrilus walshi, new species.

Male.—Small, slender, strongly attenuate posteriorly, strongly shining; head and antennae greenish blue, the former brownish black on occiput; pronotum bronzy green, blackish at middle; elytra olivaceous brown, uniformly clothed with whitish pubescence, except toward lateral margins; beneath black, with aeneous or greenish reflections.

Head with the front rather wide, feebly convex, about equal in width at top and bottom, the lateral margins parallel, deeply, narrowly, transversely grooved behind the epistoma, feebly, broadly depressed on occiput, surface finely, densely granulose, feebly, coarsely punctate on front, longitudinally rugose on occiput, densely clothed behind epistoma with long, semierect, white hairs; epistoma strongly transverse between the antennae, vaguely arcuately emarginate in front; antenna extending to basal fourth of pronotum, serrate from the fourth segment, the serrate segments about as wide as long.

Pronotum one-third wider than long, about equal in width at base and apex, widest at middle; sides feebly, arcuately rounded; posterior angles rectangular; when viewed from the side the marginal and submarginal carinae straight, narrowly separated anteriorly, but joined behind the middle; anterior margin strongly bisinuate, with the median lobe strongly produced and broadly rounded; base transversely bisinuate, without a distinct, median lobe; disk moderately convex, broadly depressed at sides, with a broad, shallow depression in front of the scutellum, and with strongly elevated, arcuate prehumeral carinae, extending from posterior angles to lateral margins in front of middle; surface deeply, irregularly, transversely rugose, finely punctate between the rugae, sparsely clothed with short, inconspicuous hairs. Scutellum strongly, transversely carinate, the surface finely reticulate.

Elytra as wide as pronotum at base, subequal in width at bases and behind middles; sides nearly parallel to behind middles (feebly constricted in front of middles), then strongly, obliquely narrowed to the tips, which are separately narrowly rounded and feebly serrate; sides of abdomen narrowly exposed above; disk slightly flattened, with broad, moderately deep, basal depressions, and each elytron with a distinct posthumeral carina extending to basal third; surface finely, densely imbricate-punctate, more or less rugose basally, densely, uniformly clothed with short, rather broad, semierect, white hairs, except toward the lateral margins, where the hairs are finer and inconspiculus.

Abdomen beneath finely granulose, with fine, transverse, crenulate lines, sparsely clothed with short, recumbent, whitish hairs; first and second sternites connate, the first armed with a distinct, round, median tubercle; last sternite broadly subtruncate at apex; vertical portions of segments not conspicuously pubescent; pygidium without a projecting carina at apex. Prosternum densely granulose, feebly rugose, sparsely clothed with short, recumbent, inconspicuous hairs; prosternal lobe broad, strongly declivous, broadly subtruncate in front; prosternal process broad, sides obliquely expanded to behind the coxal cavities, then obliquely narrowed to the apex, which is acute. Tibiae slender, straight, the anterior and middle pairs armed with a short tooth at apices. Posterior

legs missing. Tarsal claws cleft near the middles, the inner tooth of each claw slightly shorter than the outer one, and not turned inward.

Female.—Differs from the male in having the head uniformly reddish brown and not distinctly pubescent behind the epistoma, the antennae bronzy brown, the prosternal lobe feebly emarginate in front, the tibiae unarmed at apices, the tarsal claws cleft near the middles, with the inner tooth of each claw broad and much shorter than the outer one, and in not having a tubercle at middle of the first abdominal sternite.

Length, 3.75–4 mm.; width, 1–1.12 mm.

Type locality.—West Java: Mt. Tjikoendoel, Preanger.

Type.—No. 52212, United States National Museum. Paratypes in the F. C. Drescher collection.

Described from three specimens (one type). The type was collected at the type locality at an altitude of 2,000 feet, during October, 1934, by Mrs. E. Walsh; and the two paratypes were collected at Mt. Tangkoeban Prahoe, Preanger, West Java, at an altitude of 4,000 to 5,000 feet, during August, 1933, and April, 1934, by F. C. Drescher.

This species is closely allied to *mindanaoensis* Fisher, but it differs from that species in being more strongly attenuate posteriorly, and in having the pronotum more coarsely and deeply rugose, the hairs on the elytra broader, and the first abdominal sternite of the male armed at the middle with a distinct tubercle.

Trachys (Trachys) pipturi, new species.

Broadly oblong, moderately convex, about equally rounded in front and behind, widest at bases of elytra, strongly shining; above and beneath black, with a distinct aeneous or cupreous reflection; elytra ornamented with distinct, white, pubescent designs.

Head with the front broadly but not very deeply concave between the eyes, when viewed from above very broadly, feebly emarginate, with an obsolete, longitudinal, median groove extending from occiput to epistoma, the two post-oral pores distinct and widely separated; surface indistinctly, irregularly ocellate-punctate, sparsely clothed with long, recumbent, brownish yellow hairs; eyes not margined on inner sides, feebly converging toward bottom; epistoma slightly elevated, strongly transverse between the antennae, semi-circularly emarginate in front, the surface transversely reticulate; clypeal suture distinct.

Pronotum three times as wide as long at middle, considerably narrower at apex than at base, widest at base; sides strongly, obliquely converging from posterior angles to apical angles, which are rather acute and extending forward nearly on a line with the posterior fourths of the eyes; posterior angles rectangular; anterior margin broadly, arcuately emarginate; base transversely sinuate, the median lobe strongly produced and broadly rounded; disk moderately convex, without distinct depressions; surface indistinctly ocellate-punctate,

rather densely, uniformly clothed with short, semierect, brownish yellow pubescence, irregularly ornamented with inconspicuous spots of short, semierect, white hairs. Scutellum small and triangular.

Elytra one and two-fifths times longer than wide, slightly wider than pronotum at base, widest at bases; sides feebly converging from bases to middles (feebly, arcuately constricted at basal fourths), then strongly, arcuately converging to the tips, which are conjointly broadly rounded; surface broadly, feebly depressed on each side behind the humerus, feebly gibbose near apices, with broad, vague, basal depressions, but without lateral carinae, indistinctly ocellate-punctate, rather densely, uniformly clothed with short, semierect, brownish yellow and dark brown pubescence intermixed, and ornamented with short, semierect, white hairs as follows: Numerous irregular, narrow designs on basal halves, and two narrow, transverse, strongly zigzag fasciae behind the middle.

Abdomen beneath moderately convex, coarsely ocellate-punctate, the ocelli open posteriorly and more or less connected on basal sternite, sparsely clothed with short, recumbent, inconspicuous hairs. Prosternum subtruncate in front, coarsely, sparsely punctate, clothed with a few semierect, yellowish hairs; prosternal lobe slightly elevated, longer than wide, sides expanded posteriorly, broadly rounded at apex. Palpi yellowish. Tarsus and tarsal lamellae yellowish, except last tarsal segment, which is black.

Length, 3.75–4 mm.; width, 2.25–2.4 mm.

Type locality.—West Java: Mt. Gedeh, Tapos, 800 meters (Buitenzorg Residency).

Type and paratype.—No. 52213, United States National Museum. Paratypes in the Zoological Museum, Buitenzorg, and the F. C. Drescher collection.

Described from five specimens (one type). The type and three paratypes were reared during November and December 1933, from larvae mining in the leaves of "kilaleur" (*Pipturus repandus*) collected at the type locality by Dr. L. G. E. Kalshoven, and one paratype was collected at Mt. Slamat, Batoerraden (Banjoemas Residency), Mid Java, during October, 1925, by F. C. Drescher.

This species is allied to *picta* Fisher, but it differs from that species in having the epistoma longer and semicircularly emarginate in front, the prosternum transversely truncate in front and the prosternal process longer than wide, the palpi and tarsi yellowish, and by the different arrangement of the white pubescence on the dorsal surface.

THE OCCURRENCE OF ORTHOPODOMYIA ALBA IN ALABAMA (DIPTERA : CULICIDAE).

By S. E. Shields[1] and Virgil I. Miles.[2]

Orthopodomyia alba Baker, 1936 (Diptera, Culicidae) has not previously been reported, to the knowledge of the writers, other than in its type locality, Ithaca, N. Y. This paper records the finding of the species in northern Alabama.

In the examination of a lot of approximately 100 larvae taken from a sweet gum tree-hole (tree-hole #13, Gum Pond, southeast corner of Colbert County, Alabama) on June 25, 1936, one specimen, readily distinguished from the others by its hairy, whitish appearance, was immediately suspected of being a new species for this locality. When mounted and examined more closely the characters were found to agree with the original description of *Orthopodomyia alba*.

From June 25 to the last collection on August 4, a total of 30 larvae of *O. alba* was taken from this same tree-hole. They continued to appear throughout this period at the rate of approximately 2% of the total *Orthopodomyia* collected. None could be found elsewhere in spite of the numerous tree-hole collections made at various points in the Tennessee Valley Area of northern Alabama and northern Mississippi during this period. Due to the high mortality of the pupae only six adults emerged.

The determination was confirmed by Mr. F. C. Baker and Mr. G. H. Bradley of the Bureau of Entomology and Plant Quarantine and by Dr. Alan Stone of the U. S. National Museum.

Along with *O. alba* in the same habitat, the following species were found: *Orthopodomyia signifera* (Coquillett), *Aedes triseriatus* (Say) and *Anopheles barberi* Coquillett. On June 13 *Culex restuans* Theobald was found in the tree-hole from which *O. alba* was later collected.

A study of the larvae of *O. alba* collected disclosed two minor variations from the original description: (1) in one case the lateral tuft of the anal segment was more prominent, being over one-half the length of the segment and three-branched, and (2) in another instance an increase to 18 in the number of teeth in the anterior row of the comb of the 8th abdominal segment.

Literature Cited.

Baker, F. C. "A New Species of *Orthopodomyia*, *O. alba*, sp. n. (Diptera, Culicidae)" Proceedings of the Entomological Society of Washington, Vol. 38, No. 1, pp. 1–7, January, 1936.

[1] Jr. Entomologist, Federal Bureau of Entomology and Plant Quarantine. *Formerly with the Tennessee Valley Authority.*

[2] Jr. Entomologist, Malaria Research Laboratory, U. S. Public Health Service.

MINUTES OF THE 485TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

The 485th meeting of the Society was held at 8 P. M., Thursday, October 7, 1937, in the auditorium of the National Museum. Thirty-four members and eighteen visitors were present, with N. E. McIndoo presiding. The minutes of the meetings held on May 6, 1937, and May 27, 1937, were read and approved.

The chair read a message from Dr. L. O. Howard, in which were expressed his appreciation and enjoyment of the meeting held on May 27, celebrating his eightieth birthday anniversary.

J. S. Wade, reporting for the committee composed of Harold Morrison, H. G. Barber and himself, read the following resolution:

In Memorium.

William Morton Wheeler.

Resolved, that the following be adopted and entered in the minutes of this Society, October 7, 1937:

The Entomological Society of Washington has lost by death one of its outstanding members, William Morton Wheeler.

In the death of Doctor Wheeler, not only entomology but the entire field of zoological science has suffered an irreparable loss.

We offer our sincere sympathy to his family and to his many friends.

Harold Morrison, *Chairman*,
H. G. Barber,
J. S. Wade.

The following resolution, drawn up by a committee composed of E. C. Bishopp and C. E. Burnside, was read by the former:

Resolved, that the following be adopted and entered in the minutes of this society, October 6, 1937:

In the death of Dr. Gershom F. White on April 27, 1937, the Entomological Society of Washington lost an active and valued member. Although a pathologist rather than an entomologist, for many years Dr. White was intimately associated with entomologists and made a number of outstanding contributions to the solutions of entomological problems. His research extended into several fields of entomology and the results of his earnest efforts are far reaching and will benefit many people.

Our heartfelt sympathy is extended to his relatives and many friends. We recommend that a sketch of the life of Dr. White be prepared and published in the Proceedings of this Society.

F. C. Bishopp,
C. E. Burnside.

The Society voted that these resolutions be accepted and printed in the Proceedings. Biographical sketches concerning Dr. Wheeler and Dr. White, compiled by these same committees, appear elsewhere in the Proceedings.

The chair stated that during the meeting of the Executive Committee on September 2, 1937, the continued use of covers on the Proceedings similar to the one on the June, 1937, issue had been authorized. During the same meeting the Corresponding Secretary was authorized to secure fifty copies each of Vol. 31, no. 4, 1929, and Vol. 32, no 8, 1930, of the Proceedings, to be duplicated by the rotaprint process.

Under the heading of "Notes and Exhibition of Specimens," B. A. Porter read a paper by H. C. Donohoe on "Nests of Leaf-Cutting Bees in Dried Figs," which will be printed in the Proceedings.

C. F. W. Muesebeck brought to the attention of the Society the recent death in Budapest, of Dr. Geza Horvath, for many years one of the outstanding hemipterists of the world, and spoke briefly of Dr. Horvath's work on Hemiptera and his interest in the promotion of stability in nomenclature.

The first part of the regular program was the showing by Floyd F. Smith of colored motion pictures of azaleas and other flowers in Magnolia Gardens, Charleston, S. C. Dr. Smith then gave the first paper on the program, entitled "Studies on the Spread of Azalea Spot Disease by Insects," which was discussed by Ewing, White, Burnside, Cushman, McIndoo and Bishopp. This paper is to be published elsewhere.

The second paper, on "Collecting and Biological Notes on Some Minor Orders of Insects," was given by A. B. Gurney:

[An introduction to the subject of insects that are active upon snow in the U. S. during winter was made as early as 1847 when Asa Fitch described the two northeastern species of *Boreus*, *brumalis* and *nivoriundus* (Mecoptera, Boreidae) and discussed insects of other orders which normally make an appearance upon snow, although not restricted to it. This fauna includes certain Collembola, Plecoptera and Diptera. Although the biology of a European species of *Boreus* is rather well known, all details in the life history of an American species are not yet available. By examining the soil about the roots of soft mosses near the bases of trees and along woodland roads, the writer has found larvae in several localities in Massachusetts and at several places in Virginia near Washington, D. C. The larvae are not of uniform size; the larger ones have largely pupated by mid-October and the smaller ones apparently do not mature until later. The pupa is of the free or exarate type and is very active when disturbed, even moving the mandibles. *Mnium cuspidatum* L. has been identified as a host moss in Massachusetts. Food of adults may consist of both plant and animal matter. Adults have lived as long as six weeks following emergence in captivity.

[During a recent collecting trip to the Monongahela National Forest of West Virginia, in company with Mr. H. A. Allard, a considerable number of interesting Orthoptera were taken. In addition to various species, the status of which is still uncertain, several species, not rare but significant biologically, were discovered. These included cave crickets (*Ceuthophilus*, *Hadenoecus*) in several limestone caves, a pink form of the katydid (*Amblycoryphya rot. rotundifolia* (Sc.) and the Differential Grass-hopper (*Melanoplus differentialis* (Thos.) along a river bank. The distribution of the latter species in the eastern states is not yet fully understood. Near the summit of Spruce Knob (Highest point in W. Va., 4860 ft.) colonies of *Cryptocercus punctulatus* Sc. were found in decaying logs. This wingless, wood-feeding roach occurs in the Appalachian Mts. and also in Washington, Oregon and California. It is of particular interest because of a fauna of some 25 species of protozoa living in the intestine as symbionts. The structural modifications of the alimentary canal, the important functions performed by the protozoa and the comparison of roach and termite intestinal faunas are discussed in a detailed report published in 1934 by Dr. L. R. Cleveland of the Harvard Medical School.—Author's abstract.

Adjournment followed at 9.45 P. M.

CATHERINE FORD,
Recording Secretary.

TERMITE CITY, Alfred E. Emerson and Eleanor Fish, pages 127, illustrated. Rand McNally, April, 1937. $1.50.

In spite of the intent of the authors and the word of the publisher, "Termite City" is not to be relegated entirely to the children's shelf in the library or to the children's counter in bookstores. This book is a delightfully written and scientifically accurate account of termites, based on the senior author's studies in tropical America.

It is impossible for the adult to read "Termite City" without learning a very great deal about termites, and learning in such a pleasant fashion that study is unnecessary. One reads, enjoys, and absorbs facts. Written in a simple style, this story of the habits of termites should indeed make an especial appeal to children. Every one should know something of biology, but unless presented in an interesting manner, biological studies appeal to but few readers.

The authors state definitely that they write of termites in British Guiana and are not trying to tell everything about termites in other regions, although they are fully capable of doing so. If termites were swarming in your house in Louisiana, you would not (after reading the book) go out and look for a six foot nest on a purple heart tree. Nor would you expect your house and furniture to be completely demolished as was the frame house used by scientists in the tropics.

Facts that I thought were missing in the text are clearly brought out in an excellent glossary (that part of a book so difficult to write). The authors are to be complimented on revealing the important events in the life of a remarkable insect in an appealing manner. The illustrations are especially suitable for children. More books of this type are vitally needed to make children nature conscious.

—T. E. Snyder.

New Orleans, La., June 15, 1937.

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Annual dues for members are $3.00; initiation fee $1.00. Members are entitled to the Proceedings and any manuscript submitted by them is given precedence over any submitted by non-members.

OFFICERS FOR THE YEAR 1937.

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PROCEEDINGS OF THE

Entomological Society of Washington

VOL. 39 DECEMBER, 1937 No. 9

THE NOMENCLATURE OF THE THORACIC SCLERITES IN THE CULICIDAE, AND THEIR SETAE.

By W. H. W. Komp,[1]

Medical Entomologist, U. S. Public Health Service.

We owe to F. W. Edwards (1) a great forward step in the generic classification of mosquitoes, based in large degree upon distinctions found in the thoracic chaetotaxy, which applies equally well to both sexes. The bristles or setae of the pleural sclerites, as pointed out by him, are characters of excellent generic value. His early observations have been extended and confirmed by others, and assist materially not only in defining generic limits, but in identifying many closely allied species.

In too many instances the practicing systematic entomologist is called upon to identify poorly preserved female adult mosquitoes, minus legs, wing-markings, and other characters of importance in specific differentiation. Any characters which will avail in such a predicament are welcomed by the taxonomist. The distinctions pointed out by Edwards are of this sort, as even in badly denuded specimens they can be made visible by suitable treatment.

Recently developed methods of collecting adult mosquitoes, such as various forms of light-traps, usually give catches in a relatively poor state of preservation. The majority of specimens which have been collected from airplanes serving South American airports were in rather poor condition. Sometimes it is of extreme importance to know, as nearly as the material permits, the species of mosquito taken in airplanes coming from yellow fever areas. In many cases, if the genus of the specimen can be determined, a close guess can usually be made as to the species, if the fauna of the region from which it comes is well known.

In attempting to use the excellent method devised by Edwards, the lack of uniformity of nomenclature used by authors who have given later descriptions of the pleural sclerites and their setae became apparent. Further inquiry disclosed a deplorable situation, which should be rectified if the method is to prove universally useful.

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[1] From the Gorgas Memorial Laboratory, H. C. Clark, Director, Panama City, Republic of Panama.

No attempt is made in this paper to amend current conceptions regarding the homologies of the various sclerites of the mosquito thorax. Its conclusions are offered, not as the studies of a trained morphologist, but as the findings of a taxonomist who, in the course of his daily work, uses the system of differentiation worked out by Edwards. It is hoped that, if the situation with regard to nomenclature is disclosed, more general agreement as to terms will result. Even if this consummation does not occur, the paper may have value as a reference-work for all those who find the pleural setae of use in mosquito taxonomy.

The morphology of the dipterous thorax, and the homologies of its sclerites, have been the subject of exhaustive study by insect morphologists, of whom Crampton (2) (3) has done relatively recent work in the nematocerous forms. While his work has been concerned largely with forms not particularly closely related to the mosquito, his findings have been of great service in clarifying our conceptions of the morphology of the pleural sclerites of the culicid thorax. They thus serve as a basis for a nomenclature resting on a sure foundation of morphology.

THE STRUCTURE OF THE CULICID THORAX.

At the risk of seeming unduly elementary, but in order to orientate the reader, who may have forgotten most of his insect morphology, it may be well to review briefly the structure of the pleura of the dipterous thorax, so that the names used later for the various sclerites will have significance.

The thorax of a dipterous insect is composed of three segments, prothorax, mesothorax, and metathorax, in order from the head to the tail. Those authorities who have studied the subject believe that in their primitive condition the sides of the thorax were composed of three plates, forming the lateral portions of these three thoracic segments. Each of the three lateral plates is known as a pleuron (the plural of which is "pleura"). The three lateral plates corresponding to the three segments were each divided into two sclerites, an anterior one called the *episternum*, and a posterior one called the *epimeron*. These terms are used with the prefixes *pro-*, *meso-*, and *meta-*, to indicate that they are parts of the *pro*thorax, *meso*thorax, and *meta*thorax. Sometimes these sclerites were divided into an upper and a lower portion, a condition designated by the prefixes *an-* and *kat-* (Gr. ana- up, kata- down). Thus the term mes-an-episternum means the upper portion (an) of the anterior sclerite (episternum) of the mesothorax (indicated by the prefix mes-). Other terms are compounded in the same way.

A complication enters in those insects which are winged, and

in which therefore certain parts of the thorax are enlarged to give room for the wing-muscles. The plates overlying these muscles are enlarged and the other plates may be correspondingly reduced. This is true of the Diptera as a whole, in which the mesothorax is greatly enlarged.

In some instances, this increase in size of the mesothorax proceeded so far that the sclerites forming the prothorax and metathorax, anterior and posterior to the mesothorax, are so reduced and fused that they are difficult or impossible to distinguish.

The parts of the dorsum of the thorax need not detain us here, except to note that the dorsum of the prothorax is known as the pronotum, and is divided into two portions, anterior and posterior. In primitive Diptera, as in some Tipulidae (crane-flies), the two portions are dorsal in position, and are separated by a well-marked suture.

In mosquitoes a secondary complication arises in assigning morphologically correct terms to the parts of the prothorax. The anterior and posterior pronotum, normally *dorsal* in position in primitive Diptera, have migrated ventrad (towards the sternum) and caudad (towards the tail). These parts in their altered position apparently form portions of the *lateral* plates of the anterior portion of the thorax.

The sclerites of the pleura (sides) of the anterior segment of the thorax (the prothorax), which are termed the proepisternum and the proepimeron, are thus crowded downwards and reduced to insignificant proportions. Their places are occupied to a large extent by the parts of the pronotum, which have migrated ventrally.

This migration of the dorsal portions of the prothorax has been overlooked or disregarded by several authorities; thus it has followed that the true posterior pronotum, a *dorsal* part of the prothoracic segment, has been called the "proepimeron," which by definition is the posterior portion of the prothoracic pleuron, a *lateral* part.

The corresponding anterior sclerite of the prothoracic pleuron has been called the propleuron, but morphologically it is the proepisternum, the anterior sclerite (much reduced in size) of the prothoracic pleuron.

No reference has been found, in a limited search, to the term "propleuron" as applied to mosquitoes. Many authorities use the term in connection with the setae found on this part, calling them the "propleural setae." It would seem that "proepisternal setae," being morphologically significant, is the better term.

The anterior portion of the pronotum, normally dorsal in position and part of the prothoracic segment, has likewise migrated ventrally, and has divided into two lobes, more or less completely separated. This migration and separation of

these lobes, often called the "prothoracic lobes," has proceeded farther in the Anophelini than it has in some of the other Culicidae. In the genera *Sabethes* and *Sabethoides*, the prothoracic lobes are very large, and nearly contiguous dorsally.

The sclerites of the pleura of the *meta*thorax are of little importance taxonomically, with the exception of the meron. This is the small sclerite at the base of the mesepimeron, posterior to the middle coxa, and is known also as the meso-merocoxa, and incorrectly as the "lateral metasternal sclerite." The position of its upper margin with reference to the base of the hind coxa serves to differentiate the tribe Megarhinini and the tribe Sabethini (of Dyar) from the other three tribes of the Culicinae recognized by him. (Exception: *Haemagogus*, which is Aedine, but has the base of the hind coxa in line with the upper margin of the meron, as in the Megarhinini and Sabethini.) Crampton (2) has shown that the meron is derived from the posterior half of the middle coxa, by a process of fission and migration dorsally.

TERMINOLOGY OF THE PLEURA AND THEIR SETAE.

To show the confusion which exists in the nomenclature of the pleural sclerites, and the consequent confusion in the terms applied to their setae, two tables and two figures have been prepared. The first table lists the terms applied to the pleural sclerites, according to Edwards (1), (4), Freeborn (5), Dyar (6), Patton (7), Matheson (8), Root (9), Shannon (10), Christophers (11), and Gater (12).

The second table lists the terms applied to the setae of the pleural sclerites, according to the same authorities. The list of terms applied to the setae by Patton and Evans is taken from the first volume of their work (13).

The first figure has the sclerites named in the first table indicated by numbers, which correspond to the numbers in the left-hand column of the first table. Reference to these numbers will enable the reader to learn the various terms which have been applied to the sclerites.

The second figure shows the pleural setae, and is composite, as no one species of mosquito possesses all the setae shown in the diagram. The same system of numbers and reference to the table of setae is used. The numbers in the second figure do not correspond to those in the first figure, but refer to the second table.

In the first table (of sclerites), it will be noted that the mesepimeron (No. 6) is the only term used in common by all the authors listed. The proepisternum (No. 2) is known under five different names. The anterior pronotum (prothoracic lobes, No. 1) is likewise designated by five different terms. The

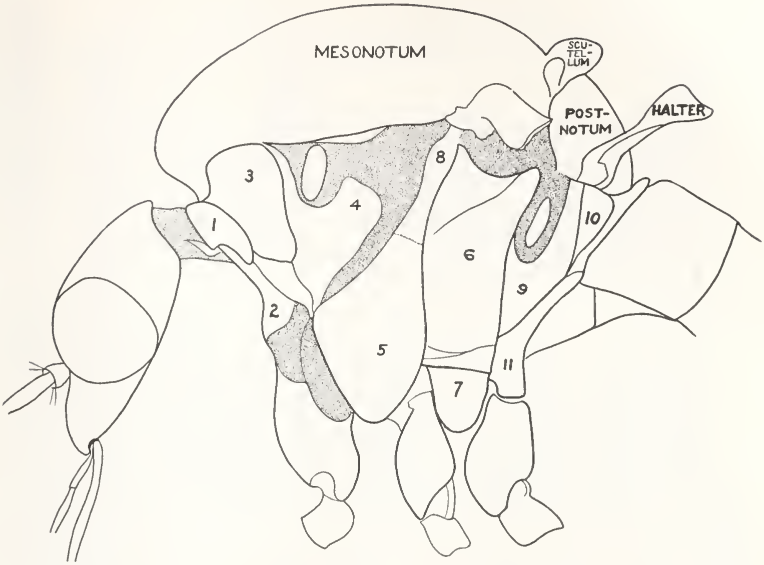

FIGURE I. Nomenclature of sclerites of pleura of Culicid thorax. 1. anterior pronotum; (prothoracic lobes). 2. proepisternum. 3. posterior pronotum. 4. mesanepisternum. 5. sternopleuron. 6. mesepimeron. 7. meron. 8. prealar area. 9. metepisternum. 10. metepimeron. 11. meteusternum.

posterior pronotum ("postspiracular area," No. 4) is known under three different names.

In the second table (of setae) there is a little more agreement in nomenclature, as four terms are used in common by all the authors.

SOME NECESSARY CORRECTIONS IN TERMINOLOGY.

In the paragraphs which follow, certain errors in nomenclature made by the authors cited are corrected.

Edwards (4) uses the terms "pleura" (singular) and "pleurae" (plural) for the sclerites of the sides of the thorax. While not absolutely incorrect, "pleura" being a secondary meaning of "pleuron" (as the latter term is used by entomologists) according to Webster, most morphologists use the word "pleuron" (singular) and its plural form "pleura."

Edwards also uses the term "proepimeron" for the posterior pronotum, in accordance with earlier conceptions of this sclerite; he states that this use of "proepimeron" is probably incorrect.

TABLE I.

SCLERITES OF PLEURA.

	Edwards I (1921)	Freeborn (1926)	Dyar (1928)	Patton (1930)	Matheson (1929)	
1	prothoracic lobes	anterior pronotum	prothoracic lobes	anterior pronotum	prothoracic lobes; pronotum*	1
2	prosternal lobes	episternum	propleura	proepisternum	proepisternum	2
3	proepimeron	posterior pronotum	pronotum	posterior pronotum	pronotum	3
4	not definitely named	(mes)anepisternum	postspiracular area	mesanepisternum	upper portion of mesepisternum	4
5	mesepisternum and mesosternum	(meso)sternopleurite	sternopleura	meskatepisternum†	posterior half of mesepisternum	5
6	mesepimeron	mesepimeron	mesepimeron	{ mesanepimeron { meskatepimeron	mesepimeron	6
7	not mentioned	meron	lateral metasternal sclerite	meron‡	not mentioned	7
8	prealar prominence	upper portion of (mes)anepisternum	not mentioned	not mentioned	dorso-posterior projection of mesepisternum	8
9	not mentioned	(met)anepisternum	not mentioned	metepisternum	not mentioned	9
10	not mentioned	(met)epimeron	not mentioned	metepimeron	not mentioned	10
11	not mentioned	(meta)sternopleurite	not mentioned	meseusternum§	not mentioned	11

*Erroneously designated. See discussion.

†In Fig. 58, p. 71 of Part II, the sclerite labeled "mkep" is erroneously stated to be the "meskatepimeron," in the small type below the figure. This is undoubtedly merely a typographical error, as the true "meskatepimeron" is properly labeled. The part is correctly designated in the legend below Fig. 57 of Patton and Evans, p. 86, Part I (13).

‡In the same figure, the labels denoting the "meron" and the "meseusternum" are transposed.

§The "meseusternum," according to its prefix "mes," is a portion of the mesothorax. Freeborn and Christophers consider the part labeled "mseu" to be a part of the metathorax.

	Root (1929)	Shannon (1931)	Edwards II (1932)	Christophers (1933)	Gater (1935)	
1	prothoracic lobe	not mentioned	pronotum	anterior pronotum; anterior pronotal lobe; (prothoracic lobe)	anterior pronotum; pronotal lobe	1
2	propleura	propleura	propleura	propleuron: episternum	proepisternum	2
3	posterior pronotum	proepimeron	proepimeron	postpronotum	posterior pronotum	3
4	mesopleura	preanepisternum; meso-pleura; post-spiracular area	post-spiracular area	mesothoracic anepisternum	mesanepisternum	4
5	sternopleura	sternopleura	sternopleura	sternopleuron of mesothorax	meskatepisternum	5
6	mesepimeron	mesepimeron	mesepimeron	mesepimeron	mesepimeron: { mesanepimeron, meskatepimeron }	6
7	lateral metasternal sclerite	meso-merocoxa	meron	meron	meron	7
8	not mentioned	not mentioned	prealar knob	prealar area	upper portion of meskatepisternum	8
9	not mentioned	not mentioned	not mentioned	not mentioned	metepisternum	9
10	not mentioned	not mentioned	not mentioned	metathorax	metepimeron	10
11	not mentioned	not mentioned	not mentioned	sternopleuron of metathorax	not mentioned	11

TABLE II.

NOMENCLATURE OF PLEURAL SETAE.

	Edwards I (1921)	Freeborn (1926)	Dyar (1928)	Patton & Evans (1929)	Matheson (1929)	
1	pronotal	anterior pronotals	prothoracic	anterior pronotal	prothoracic	1
2	prosternal	episternals	propleural	proepimeral	prosternal	2
3	proepimeral	posterior pronotals or proepimerals	pronotal; proepimeral	posterior pronotal	pronotal	3
4	spiracular	spiraculars	spiracular	spiracular	spiracular	4
5	post-spiracular	postspiraculars	postspiracular	postspiracular	post-spiracular	5
6	pre-alar	prealars	prealar	prealar	pre-alar	6
7	sternopleural	sternopleurals	sternopleural	lower sternopleural	sterno-pleural	7
8	mesepimeral upper / lower	mesepimerals upper / lower	mesepimeral	hypopleural upper / lower	mesepimeral not mentioned / lower	8

	Root (1929)	Shannon (1931)	Edwards II (1932)	Christophers (1933)	Gater (1935)	
1	prothoracic	prothoracic	anterior pronotal	anterior pronotal	anterior pronotal	1
2	propleural	propleural	propleural	propleural	propleural	2
3	pronotal	not mentioned	posterior pronotal	not mentioned	not mentioned	3
4	spiracular	spiracular	spiracular	spiracular	spiracular	4
5	postspiracular	postspiracular	post-spiracular	not mentioned	not mentioned	5
6	prealar	not mentioned	pre-alar	prealar	prealar	6
7	sternopleural upper / lower	sternopleural	sternopleural	sternopleural upper / lower	sternopleural upper / lower	7
8	mesepimeral upper / mid	mesepimeral	sub-alar / lower mesepimeral	mesepimeral upper / not mentioned	mesepimeral sub-alar / lower mesepimeral	8

Root (9) uses the term "mesopleura" for the mesanepisternum, but Crampton (3) states that this designation should be given to "both entire flanks or pleura of the mesothorax."

Shannon (10) also uses the term "mesopleura" for the mesanepisternum.

Matheson (8) states (p. 6, line 15), that the pronotal setae are located on the posterior margin of the "pronotum," evidently designating the posterior pronotum as the pronotum. On p. 11, line 16, he states that the pronotum is "represented by the two prothoracic lobes."

Patton & Evans (13), in Fig 163, label the setae on the proepisternum (propleuron) as the "proepimeral" setae. There is no justification either on morphological grounds, or in entomological usage, for this designation.

Patton, in Fig. 58 of his second volume (7), designates correctly the sclerite on which the so-called "proepimeral" setae occur as the "proepisternum."

Several typographical errors mar the accuracy of his Fig. 58. The meron is incorrectly designated the "meseusternum," and vice versa. The meseusternum, by definition, should be a part of the mesothorax, but it very evidently is a part of the metathorax, and should be designated the meteusternum.

The legend beneath the figure contains a misprint, in which the sclerite "mkep" is called the "meskatepimeron," when it is evidently the "meskatepisternum." The true "meskatepimeron" is labeled "mkepm."

Dyar (6) gives a figure, No. 1 on Plate I, page 473, of the lateral view of the thorax. In this figure, some of the pleural setae are named. The sclerites are not designated. It has been necessary, therefore, in drawing up his list of terms for setae and sclerites, to refer to the designations given in his table of tribes and genera on page 4. The incompleteness of figure 1 on Plate I renders this table of genera useless to the occasional taxonomist, who may have no knowledge of the location of the various setae mentioned in the table.

The location is not shown of the "proepimeral" setae (p. 6, line 14), which are incorrectly called the "pronotal" setae in the diagram; they should be designated the "posterior pronotal" setae. The prothoracic lobes (anterior pronotum) are figured, but not designated. The propleural setae are shown, but also not designated, although they are mentioned in the table (p. 6, line 26). The positions of the "mid-mesepimeral" setae (p. 7, line 14) and of the "prescutellar" setae (p. 6, line 3 from bottom) are not figured.

The dichotomy (No. 9, p. 6) indicating the separation of the genus *Menolepis* from genus *Miamyia*, if worked backwards through the preceding dichotomies, is incorrect if the characters of the genus *Menolepis* are correctly given on p. 66. Thus:

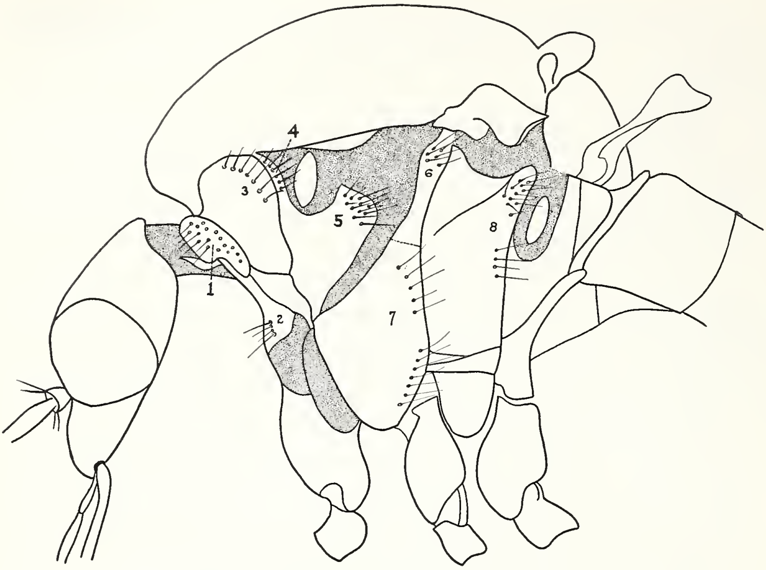

FIGURE 2. Nomenclature of pleural setae of Culicid thorax. 1. anterior pronotal (setae of prothoracic lobes). 2. proepisternal. 3. posterior pronotal. 4. spiracular. 5. postspiracular. 6. prealar. 7. sternopleural. 8. mesepimeral.

(9) Wing-scales narrow. (7) Lower sternopleural setae extending as far as, usually above upper margin of lateral metasternal sclerite. (6) Spiracular setae present. (4) Prealar setae present. (3) *No* [posterior] pronotal setae; prothoracic lobes *not* widely separated.

On page 66 it is stated: "Pronotal setae *present*, prothoracic lobes *widely separated*," in direct contradiction to the characters given in the key (second half of dichotomy 3, p. 6).

SUGGESTED TERMINOLOGY.

As an approach to an exact nomenclature, based on morphology, the following terms for the pleural sclerites are suggested as desirable. The numbers preceding the terms apply to the numbers in Figure 1, indicating the location of the pleural sclerites. These terms are given in the legend below this figure.

(1) anterior pronotum; (prothoracic lobes)
(2) proepisternum
(3) posterior pronotum

(4) mesanepisternum
(5) sternopleuron
(6) mesepimeron
(7) meron
(8) prealar area
(9) metepisternum
(10) metepimeron
(11) meteusternum

A similar terminology for the setae of the pleura is listed below. The numbers preceding the terms apply to the numbers in Figure 2, indicating the pleural setae, and these terms are given in the legend below this figure.

(1) anterior pronotal; (setae of prothoracic lobes)
(2) proepisternal
(3) posterior pronotal
(4) spiracular
(5) postspiracular
(6) prealar
(7) sternopleural
(8) mesepimeral

Where the terms in earlier use are more familiar, or are preferred by the individual worker, it is recommended that these be given also in parentheses, after the correct morphological terms, in future publications. If the older term is simply an alternative designation, it may be enclosed merely in parentheses. If the term is morphologically incorrect, and therefore a misnomer, it may be enclosed in parentheses and quotation marks. Instances in which this procedure would be extremely useful are: anterior pronotum (prothoracic lobes), posterior pronotum ("proepimeron"), meron ("lateral metasternal sclerite").

CONCLUSION.

It is hoped that the tables and figures given in this paper will be of assistance to entomologists and others interested in mosquito taxonomy. They may be used as references in studying the works of the various authorities, and as guides to the proper use of terms in future publications.

That some such analysis as forms the subject of this paper seems necessary, in order to guard against further errors and confusion, ought to be self-evident from the chaotic situation disclosed regarding the nomenclature of the pleural sclerites and their setae.

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THE FEMALE GENITALIA OF THE AEDES MOSQUITOES OF THE PACIFIC COAST STATES.[1]

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Classification of female mosquitoes of the genus *Aedes* is based largely on the coloration of the scales which cover most of the body. In a number of species this coloration is nearly identical. Individuals of a species also vary somewhat in color and so intergrade with those of other species. The scales of the body may often be brushed off in collecting the specimens, and toward the end of the season many of the specimens are normally brushed and weather-beaten. It is therefore difficult and in many cases impossible to identify such specimens as to species.

When determination can not be made from female specimens it is necessary to use the additional characters furnished by larvae and male genitalia. However, larvae and males are often

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difficult to obtain and any additional characteristics of the females which would be of value in identifying them directly would be very desirable.

Several attempts have been made to utilize female genitalia in the classification of mosquitoes. Christophers (*2*) has studied the structures and development of species from three different genera of Culicidae. He concludes, "The hypopygial characters in the female do not exhibit any striking lead as to their use in classification, but as there are distinct specific and group characters they may have utility in certain cases."

Gerry (*4*) has reviewed the literature on the subject. He finds that in the work of Broleman (*1*), and Macfie and Ingram (*5*), "the terminal segments were not sufficiently extended to afford a clear view of the ninth and tenth sternites," and that the failure of Davis (*3*), "to find variations in the terminal segments may be due to his method of preparation."

Gerry (*4*) has also described the female genitalia of 19 species of Cuban mosquitoes from 8 different genera. He finds that, "the female hypopygia present a striking contrast, in that each generic group possess certain unique, idiomorphic characteristics which may be utilized in the formation of generic classification. In addition several promising specific characters have been observed, some of which are not manifest, but may be made visible with the aid of a microscope."

The female genitalia of the species described and illustrated in this paper provide morphological characters which may be used to separate some of these species. In most instances, however, these are the more distinctly marked forms which can usually be identified by their coloration. The species having similar or identical coloration have been found to have nearly identical genitalia. Female genitalia in this group have, therefore, only limited value for taxonomic purposes.

DEVELOPMENT AND MORPHOLOGY.

Christophers (*2*) in his study of the structure and development of the female genitalia, has described the various parts, given names to a number of them, and shown how they develop in the last larval instar and pupa. He did not, however, attempt to determine the homology of some of the ventral sclerites, particularly those of the postgenital plate.

Gerry (*4*) in an extensive study has shown the origin of these various structures. As a result of these studies he finds that in the Culicidae the tenth and eleventh sternites are fused to form the postgenital plate and that "the line of fusion between the eleventh and tenth sternites is represented by a slight constriction located about halfway between the base and the apex of the composite postgenital plate." He has also shown that the tenth tergite is reduced to two small plates in a number

of genera of Culicidae and disappears entirely in *Aedes* and several other genera.

In the genus *Aedes* all or parts of the eighth, ninth, tenth, and eleventh segments have been modified for use as genitalia. In addition to these segments, there are the cerci, which, according to Gerry (*4*), are appendages arising from the eleventh segment.

The postgenital plate is composed of the eleventh sternite and the sclerotized portions of the cowl or tenth sternite. This sclerotized median portion of the cowl is of about the same width as the eleventh sternite, and the nonsclerotized portions are marked by a fold of the integument which is continuous with the line of fusion between the tenth and eleventh sternites.

SPECIFIC CHARACTERS.

A limited number of useful taxonomic characters have been found in this group. Differences have been found to occur in the eighth segment, in the ninth tergite and sternite, in the cerci, sigma, insula plate, and postgenital plate. With the exception of the postgenital plate and the ninth tergite, these structures show little variation in the individuals of the species. In the postgenital plate, however, specimens are found to vary considerably from the shape typical for the species. Considerable variation also occurs in the shape of the ninth tergite in many species. In order that the margins of this structure may be seen clearly, dissection is almost necessary, and because of these variations the ninth tergite does not furnish reliable taxonomic characters in this group. Spines which occur on the postgenital plate, insula plate, and lobes of the ninth tergite have been found to be of little value, since in many instances they vary in number in the individuals of the species.

ILLUSTRATIONS.

Normally the sigma is folded back under the ninth sternite. In the illustrations, in order to show its shape and the shape of the insula plate, it has been shown extending anteriorly. The ninth tergite has been drawn to show its outline when flattened out rather than its normal aspect. Conspicuous variations occur in the posterior margin of the eighth segment in a number of species. A section of the sternite has therefore been included with the genitalia of each species.

METHOD OF PREPARATION AND MOUNTING.

A pair of small scissors may be used to remove the genitalia from the specimen. After they have been removed they should be placed in a solution of potassium hydroxide. The time required will depend on the temperature and concentration of the solution, and the size of the specimen. Immersion in a 10-per

cent solution at room temperature for 2 to 6 hours is usually sufficient for small species, while 8 to 14 hours may be required for larger species. The time may be proportionately shortened by placing the solution containing the genitalia on a warmed surface. The genitalia should be examined from time to time and care should be taken not to leave them in too long, as they will then become colorless and the outlines of the various structures can not be seen distinctly.

When inspection shows the genitalia to be sufficiently softened and transparent, they should be placed in distilled water for a few minutes to remove the potash. They may then be placed in a drop of water on a glass slide and the organic matter pressed out with a pair of dissecting needles or insect pins. They should then be washed again in distilled water.

The genitalia may now be mounted in a drop of Canada balsam or Buxton's mixture. In preparing specimens for this study Buxton's mixture was used, since (as this is a water-soluble mixture) it is then unnecessary to dehydrate the specimens before mounting.

In order that the structures of the genitalia may be made visible, the ninth and tenth segments should be well expanded by holding the anterior segment with a needle and pressing out these segments with another needle. If a water-soluble mounting fluid is to be used, this may be done after the fluid has been applied. If it is desired to obtain a better view of some particular part, the genitalia may be conveniently dissected in the drop of mounting fluid. After the cover glass has been placed over the specimen, it may be turned to show the desired view by a slight downward and sidewise pressure of the coverglass.

If Canada balsam is to be used the specimen should first be passed through 70, 95, and 100 per cent alcohol and should be transferred to xylol before mounting. The ninth and tenth segments should be expanded before they are passed through the alcohols, since alcohol causes them to become brittle.

Key to the Female Genitalia of the Aedes of the Pacific Coast States.

1. Postgenital plate two-thirds the length of the cerci .... *varipalpus*
   Postgenital plate one-half the length of the cerci 2
2. Eighth segment, except posterior margin of sternite, non-sclerotized .... *nigromaculis*
   Eighth segment completely sclerotized 3
3. Posterior margin of eighth sternite in form of inverted brace .... *cinereus*
   Posterior margin of eighth sternite convex, with central emargination 4
   Posterior margin of eighth sternite convex, without central emargination 5
4. Postgenital plate with deep V-shaped emargination .... *vexans*
   Postgenital plate without emargination .... *taeniorhynchus*
5. Lateral margins of the postgenital plate narrowed from the upper third to the base .... *dorsalis*

Lateral margins of the postgenital plate straight or narrowed from the lower third to the base	*ventrovittis* *idahoensis* *aldrichi* *impiger*
Lateral margins of the postgenital plate narrowed from the lower third to a short neck at the base	*aloponotum* *hexodontus* *communis* *aboriginis* *fitchii* *increpitus* *flavescens* *squamiger* *cataphylla* *pullatus*

DESCRIPTIONS OF THE FEMALE GENITALIA.

Subgenus CULICELSA Felt.

Aedes (Culicelsa) varipalpus (Coquillett).

Culex varipalpus Coquillett, Can. Ent., xxxiv, 292, 1902.
Aedes (*Culicelsa*) *varipalpus* Freeborn, Mosq. of Calif., 416, 1926.
Aedes (*Taeniorhynchus*) *varipalpus* Dyar, Mosq. of Amer., 214, 1928.

Cerci moderately short, flat, bluntly pointed; outer margin curved, inner margin more nearly straight. Postgenital plate slightly emarginate or straight apically, two-thirds the length of the cerci; lateral margins straight and narrowed sharply at the base, the surface supporting two groups of two long setae apically and about 14 short spine-like setae subapically. Cowl fused to the postgenital plate at the middle, and gradually expanded laterally to fuse with the margins of the ninth tergite. Ninth sternite narrow, the lateral shoulders slightly dilated, the lateral arms slightly wider at the middle. Sigma narrow, uniform in width, folding back under the ninth sternite and ending in a flat half oval insula plate which supports two groups of two or three setae. Ninth tergite broad, moderately bilobed posteriorly; lateral margins narrowing anteriorly to end in a shallow flaring V-shaped indentation; the posterior lobes each crowned by a group of six or seven fine setae. Anal segment membranous and domed, continuous ventrally with the basal half of the postgenital plate and the ninth sternite and dorsolaterally with the ninth tergite. Eighth sternite with posterior margin convex.

Aedes (Culicelsa) taeniorhynchus[2] (Wiedemann).

Culex taeniorhynchus Wiedemann, Dipt. Exot., 43, 1821
Aedes (*Culicelsa*) *taeniorhynchus* Freeborn, Mosq. of Calif., 10, 414, 1926.
Aedes (*Taeniorhynchus*) *taeniorhynchus* Dyar, Mosq. of Amer., 218, 1928.

Cerci long, flat, bluntly pointed; outer margin curved, inner margin more nearly straight. Postgenital plate straight or slightly emarginate apically,

[2] The genitalia of this species have been described and illustrated by Gerry (*4*) from specimens from Cuba. Specimens described here are from California, Florida, and Delaware and differ considerably from those described from Cuba in the shape of the postgenital plate and the ninth tergite.

half the length of the cerci, the lateral margins straight; the surface supporting two groups of two long setae apically and a total of four to six short spine-like setae subapically. Cowl fused to the postgenital plate one-third of the distance from the apex, and gradually expanded laterally to fuse with the margins of the ninth tergite. Ninth sternite narrow, the lateral shoulders slightly dilated, the lateral arms slightly wider at the middle. Sigma narrow, uniform in width, folding back under the ninth sternite and ending in a flat half-oval insula plate which supports two groups of two setae. Ninth tergite broad, with a fairly deep V-shaped indentation posteriorly, the lateral margins narrowing anteriorly; the anterior margin with a V-shaped indentation; the posterior lobes each crowned by a group of four or five fine setae. Anal segment membranous and domed, continuous ventrally with the basal two-thirds of the postgenital plate and the ninth sternite, and dorsolaterally with the ninth tergite. Posterior margin of eighth segment with flaring V-shaped indentation centrally.

Aedes (Culicelsa) nigromaculis (Ludlow).

Grabhamia nigromaculis Ludlow, Geo. Wash. Univ. Bull., 85, 1907.
Aedes (*Taeniorhynchus*) *nigromaculis* Dyar, Mosq. of Amer., 215, 1928.

Cerci long, flat, bluntly pointed; outer margin curved, inner margin nearly straight. Postgenital plate half the length of the cerci; the lateral margins regular, diverging slightly to the base, the margin of the apex in the form of a half circle flattened at the top, the surface supporting two pairs of two long setae apically and one to four short spine-like setae subapically. Cowl fused to the postgenital plate one-third of the distance from the apex, and gradually expanded laterally to fuse with the margin of the ninth tergite. Ninth sternite narrow, the lateral shoulders slightly dilated, the lateral arms slightly wider at the middle. Sigma narrow, uniform in width, folding back under the ninth sternite and ending in a flat half-oval insula plate with two groups of three or four setae. Ninth tergite broad, with a deep V-shaped indentation; the lateral margins with hook-like projections at their widest point and narrowing anteriorly; the posterior lobes each crowned by a group of five to seven fine setae. Anal segment membranous and domed, continuous ventrally with the basal two-thirds of the postgenital plate and the ninth sternite and dorsolaterally with the ninth tergite. Posterior margin of eighth sternite with V-shaped indentation centrally. The cuticula of the eighth segment membranous and nonsclerotized except at posterior margin of eighth sternite.

Subgenus AEDES Meigen.

Aedes (Aedes) cinereus Meigen.

Aedes cinereus Meigen, Syst. Beschr. Eur. Zweifl. Ins., i, 13, 1918.
Aedes (*Aedes*) *cinereus hemiteleus* Freeborn, Mosq. of Calif., 406, 1926.
Aedes (*Aedes*) *cinereus* Dyar, Mosq. of Amer., 238, 1928.

Cerci long, flat, pointed; outer margin curved, inner margin nearly straight. Postgenital plate slightly emarginate apically, half the length of the cerci, the lateral margins straight to the lower third, expanded, and constricted to normal width again at the base; the surface supporting two groups of two long setae

apically and about ten shorter spine-like setae subapically. Cowl fused to the postgenital plate two-thirds of the distance from the apex, gradually expanded laterally to fuse with the margins of the ninth tergite. Ninth sternite narrow, the lateral arms wider at the middle. Sigma narrow, uniform in width, folding back under the ninth sternite and ending in a tongue-shaped insula plate. Ninth tergite broad, slightly bilobed posteriorly; the lateral margins narrowing abruptly at the middle and continuing anteriorly in a more gradually converging form; the anterior margin with a deep U-shaped indentation; the posterior lobes each crowned by a group of 12 fine setae. Anal segment membranous and domed, continuous ventrally with the basal third of the postgenital plate ana the ninth sternite and dorsolaterally with the ninth tergite. Eighth sternite with posterior margin in form of an inverted brace.

Subgenus **AEDIMORPHUS** Theobald.

Aedes (Aedimorphus) vexans (Meigen).

Culex vexans Meigen, Syst. Beschr. Eur. Zweifl. Ins., vi, 241, 1830.
Aedes (*Aedimorphus*) *vexans* Freeborn, Mosq. of Calif., 410, 1926.
Aedes (*Aedimorphus*) *vexans* Dyar, Mosq. of Amer., 236, 1928.

Cerci long, flat, bluntly pointed; inner margin nearly straight, outer margin curved and converging to form a short neck at the base. Postgenital plate with a deep V-shaped indentation apically, half the length of the cerci; the lateral margins converging gradually and narrowing more sharply to a short neck at the base; the surface supporting two groups of two long setae apically and about eight short spine-like setae subapically. Cowl fused to the postgenital plate one-third of the distance from the apex, and gradually expanded laterally to fuse with the margins of the ninth tergite. Ninth sternite narrow, the lateral shoulders slightly dilated, the lateral arms slightly wider at the middle. Sigma narrow, uniform in width, folding back under the ninth sternite and ending in a narrow, tongue-like insula plate. Ninth tergite broad, moderately bilobed posteriorly, narrowing anteriorly, the anterior margin moderately emarginate; the posterior lobes each crowned by a group of five or six setae. Anal segment membranous and domed, continuous ventrally with the basal two-thirds of the postgenital plate and the ninth sternite and dorsolaterally with the ninth tergite. Posterior margin of the eighth sternite with a deep flaring U-shaped indentation centrally.

Subgenus **OCHLEROTATUS** Lynch Arribalzaga.

Aedes (Ochlerotatus) pullatus (Coquillett).

Culex pullatus Coquillett, Proc. Ent. Soc. Wash., vi, 168, 1904.
Aedes (*Ochlerotatus*) *pullatus* Dyar, Mosq. of Amer., 171, 1928.

Cerci long, flat, bluntly pointed; outer margin curved, inner margin nearly straight. Postgenital plate emarginate or straight apically, half the length of the cerci; the lateral margins narrowed at the middle and to a short neck at the base, the lower half slightly wider than the upper half; the surface supporting two groups of three long setae apically and about eight short spine-like setae subapically. Cowl fused to the postgenital plate at the middle and gradually

expanded laterally to fuse with the margins of the ninth tergite. Ninth sternite narrow, the lateral arms slightly wider at the middle. Sigma narrow, uniform in width, folding back under the ninth sternite and ending in a flat half-oval insula plate which supports two groups of two or three setae. Ninth tergite broad, with V-shaped indentation posteriorly and a wide deep flaring U-shaped indentation anteriorly; the lateral margins with hook-like projections at their widest point and narrowing anteriorly; the posterior lobes each crowned by a group of four or five fine setae. Anal segment membranous and domed, continuous ventrally with the basal half of the postgenital plate and the ninth sternite and dorsolaterally with the ninth tergite. Eighth sternite with posterior margin convex.

Aedes (Ochlerotatus) fitchii (Felt and Young).

Culex fitchii Felt and Young, Science, n. s. xxx, 313, 1904.
Aedes (Ochlerotatus) fitchii palustris Freeborn, Mosq. of Calif., 399, 1926.

Cerci long, flat, bluntly pointed, outer margin curved, inner margin nearly straight. Postgenital plate emarginate apically, half the length of the cerci; the lateral margins constricted above the middle more sharply and deeply to a short neck at the base; the surface supporting two groups of two or three long setae apically and numerous short spine-like setae subapically. Cowl fused to postgenital plate at the middle, and gradually expanded laterally to fuse with the margins of the ninth tergite. Ninth sternite narrow, the lateral shoulders slightly dilated, the lateral arms slightly wider at the middle. Sigma narrow, uniform in width, folding back under the ninth sternite and ending in a flat half-oval insula plate which supports two groups of two or three setae. Ninth tergite broad, moderately bilobed posteriorly; the lateral margins with or without slight hook-like projections at their widest point and narrowing anteriorly, the anterior margin with a shallow V-shaped indentation or straight, the posterior lobes crowned by a group of six to nine fine setae. Anal segment membranous and domed, continuous ventrally with the basal half of the postgenital plate and the ninth sternite and dorsolaterally with the ninth tergite. Eighth sternite with posterior margin convex.

Aedes (Ochlerotatus) aboriginis Dyar.

Aedes aboriginis Dyar, Ins. Ins. Mens., v. 99, 1917.
Aedes aboriginis Hearle, Nat. Res. Counc. Rept., No. 17, 51, 1926.
Aedes (Ochterotatus) aboriginis Dyar, Mosq. of Amer., 184, 1928.

Characters the same as those of *Aedes fitchii* except as follows: The lateral margins of the postgenital plate slightly constricted at the middle. The lateral margins of the ninth tergite with rounded projections at their widest point; the posterior lobes each crowned by a group of five to ten fine setae.

Aedes (Ochlerotatus) aloponotum Dyar.

Aedes aloponotum Dyar, Ins. Ins. Mens., v, 98, 1917.
Aedes aloponotum Hearle, Nat. Res. Counc. Rept., No. 17, 55, 1926.
Aedes (Ochlerotatus) aloponotum Dyar, Mosq. of Amer., 204, 1928.

Characters the same as those of *Aedes fitchii* except as follows: The lateral margins of the postgenital plate usually narrowed a little more deeply just above the base. The lateral margins of the ninth tergite with hooklike projections at their widest point and narrowing anteriorly; the posterior lobes each crowned by a group of five to eight fine setae.

Aedes (Ochlerotatus) idahoensis (Theobald).

Grabhamia spencerii var. *idahoensis* Theobald, Mon. Culic., iii, 250, 1903.
Aedes (*Ochlerotatus*) *idahoensis* Dyar, Mosq. of Amer., 177, 1928.

Characters the same as those of *Aedes fitchii* except as follows: Postgenital plate straight or slightly emarginate apically; the lateral margins slightly constricted one-third the distance below the apex and narrowing either in a straight line or gradual curve from lower third to the base. Cowl fused to the postgenital plate one-third the distance from the apex. The lateral margins of the ninth tergite with hook-like projections at their widest points and narrowing anteriorly; the posterior lobes each crowned by a group of five or six fine setae. The anal segment continuous ventrally with the basal two-thirds of the postgenital plate.

Aedes (Ochlerotatus) ventrovittis Dyar.

Aedes ventrovittis Dyar, Ins. Ins. Mens., iv, 84, 1916.
Aedes (*Ochlerotatus*) *ventrovittis* Freeborn, Mosq. of Calif., 378, 1926.
Aedes (*Ochlerotatus*) *ventrovittis* Dyar, Mosq. of Amer., 185, 1928.

Characters the same as those of *Aedes fitchii* except as follows: Postgenital plate straight or slightly emarginate apically, the lateral margins slightly constricted one-third the distance below the apex and straight, or slightly narrowed from the lower third, to the base. Cowl fused to the postgenital plate one-third the distance from the apex. The lateral margins of the ninth tergite with hook-like projections at their widest point and narrowing anteriorly, the posterior lobes each crowned by a group of six or seven fine setae. The anal segment continuous ventrally with the basal two-thirds of the postgenital plate.

Aedes (Ochlerotatus) squamiger (Coquillett).

Culex squamiger Coquillett, Proc. U. S. Nat. Mus., xxv, 85, 1902.
Aedes (*Ochlerotatus*) *squamiger* Freeborn, Mosq. of Calif., 403, 1926.
Aedes (*Ochlerotatus*) *squamiger* Dyar, Mosq. of Amer., 212, 1928.

Characters the same as those of *Aedes fitchii* except as follows: The outer margin of the cerci curved to a slight notch just above the base. The lateral margins of the postgenital plate constricted at the middle and narrowed to a moderately long neck at the base. The lateral margins of the ninth tergite with hook-like projections at their widest point and narrowing anteriorly; the posterior lobes each crowned by a group of six to eight fine setae.

Aedes (Ochlerotatus) dorsalis (Meigen).

Culex dorsalis Meigen, Syst. Besch. Eur. Zweifl. Ins. 242, 1830.
Aedes (*Ochlerotatus*) *dorsalis* Freeborn, Mosq. of Calif., 368, 1926.
Aedes (*Ochlerotatus*) *dorsalis* Dyar, Mosq. of Amer., 200, 1928.

Characters the same as those of *Aedes fitchii* except as follows: The lateral margins of the postgenital plate gradually narrowed below the apical third and more sharply narrowed just above the base. The lateral margins of the ninth tergite with projections at their widest point and narrowing anteriorly; the posterior lobes each crowned by a group of four to seven fine setae.

Aedes (Ochlerotatus) flavescens (Müller).

Culex flavescens Müller, Faun. Ins. Fried., 87, 1764.
Aedes flavescens Hearle, Nat. Res. Counc. Rept., No. 17, 56, 1926.
Aedes (*Ochlerotatus*) *flavescens* Dyar, Mosq. of Amer., 206, 1928.

Characters the same as those of *Aedes fitchii* except as follows: The lateral margins of the postgenital plate straight or slightly constricted at the middle. The posterior lobes of the ninth tergite each crowned by a group of 5 to 12 fine setae.

Aedes (Ochlerotatus) aldrichi Dyar and Knab.

Aedes aldrichi Dyar and Knab, Proc. U. S. Nat. Mus., xxxv, 57, 1908.
Aedes aldrichi Hearle, Nat. Res. Counc. Rept., No. 17, 35, 1926.
Aedes (*Ochlerotatus*) *aldrichi* Dyar, Mosq. of Amer., 176, 1928.

Characters the same as those of *Aedes fitchii* except as follows: The lateral margins of the postgenital plate straight or slightly constricted at the middle and moderately narrowed at the base. The lateral margins of the ninth tergite with hook-like projections at their widest point and narrowing anteriorly; the posterior lobes each crowned by a group of seven to nine fine setae.

Aedes (Ochlerotatus) impiger (Walker).

Culex impiger Walker, List. Dipt. Brit. Mus., i, 6, 1848.
Aedes (*Ochlerotatus*) *impiger* Freeborn, mosq. of Calif., 392, 1926.
Aedes (*Ochlerotatus*) *impiger* Dyar, Mosq. of Amer., 189, 1928.

Characters the same as those of *Aedes fitchii* except as follows: The lateral margins of the postgenital plate straight except where they are narrowed at the base. The lateral margins of the ninth tergite with hook-like projections at their widest point and narrowing anteriorly; the posterior lobes each crowned by a group of four to six fine setae.

Aedes (Ochlerotatus) communis (DeGeer).

Culex communis DeGeer, Mem. Ins., vi, plate 17, figs. 2 and 5, 1776.
Aedes (*Ochlerotatus*) *communis tahoensis* Freeborn, Mosq. of Calif., 383, 1926
Aedes (*Ochlerotatus*) *communis* Dyar, Mosq. of Amer., 192, 1928.

Characters the same as those of *Aedes fitchii* except as follows: The lateral margins of the postgenital plate straight or slightly constricted at the middle. The lateral margins of the ninth tergite with hook-like projections at their widest point and narrowing anteriorly; the posterior lobes each crowned by a group of four to six fine setae.

Aedes (Ochlerotatus) cataphylla Dyar.

Aedes cataphylla Dyar, Ins. Ins. Mens., iv, 86, 1916.
Aedes (Ochlerotatus) cataphylla Freeborn, Mosq. of Calif., 388, 1928.
Aedes (Ochlerotatus) cataphylla Dyar, Mosq. of Amer., 190, 1928.

Characters the same as those of *Aedes fitchii* except as follows: The lateral margins of the postgenital plate straight or slightly constricted at the middle. The posterior lobes of the ninth tergite crowned by a group of five to nine setae.

Aedes (Ochlerotatus) increpitus Dyar.

Aedes increpitus Dyar, Ins. Ins. Mens., iv, 87, 1916.
Aedes (Ochlerotatus) increpitus Freeborn, Mosq. of Calif., 395, 1926.
Aedes (Ochlerotatus) increpitus Dyar, Mosq. of Amer., 205, 1928.

Identical with *Aedes fitchii*.

Aedes (Ochlerotatus) hexodontus Dyar.

Aedes hexodontus Dyar, Ins. Ins. Mens., 83, 1916.
Aedes (Ochlerotatus) hexodontus Freeborn, Mosq. of Calif., 375, 1926.
Aedes (Ochlerotatus) hexodontus Dyar, Mosq. of Amer., 185, 1928.

Characters the same as those of *Aedes fitchii* except as follows: The lateral margins of the postgenital plate straight or slightly constricted at the middle. The lateral margins of the ninth tergite with hook-like projections at their widest point and narrowing anteriorly; the posterior lobes each crowned by a group of five to seven fine setae.

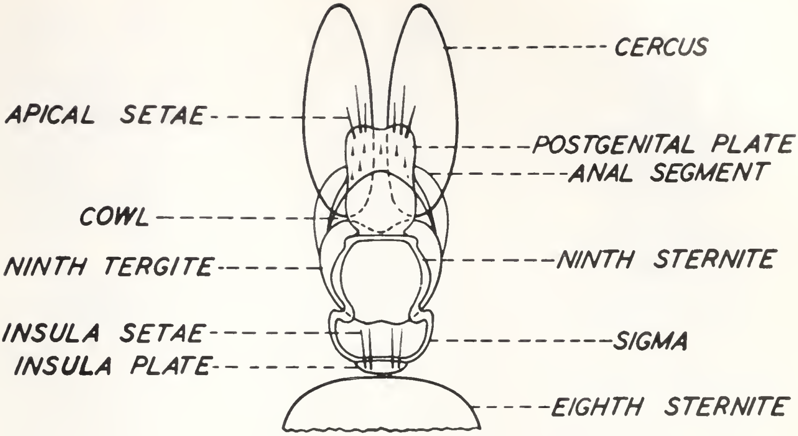
CONCLUSIONS.

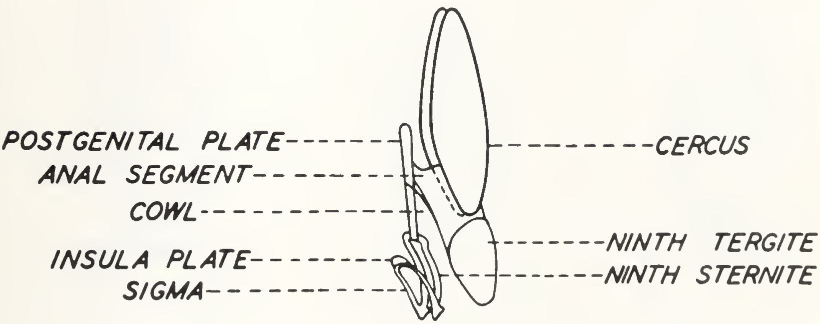
(1) In females of the genus *Aedes* all or parts of the eighth, ninth, tenth, and eleventh segments have been modified for use as genitalia.

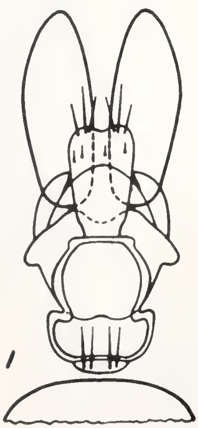
(2) Considerable variation occurs within the species in the shape of the postgenital plate and the ninth tergite and also in the number of setae on these two structures and the insula plate.

(3) Morphological differences in the eighth segment provide useful characters in a number of species.

(4) Female genitalia provide a limited number of morphological characters which are useful in determining some of the species in this group.



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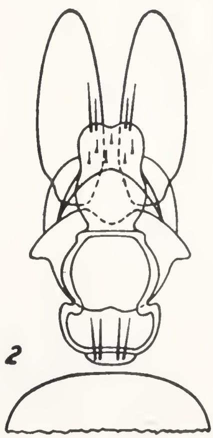
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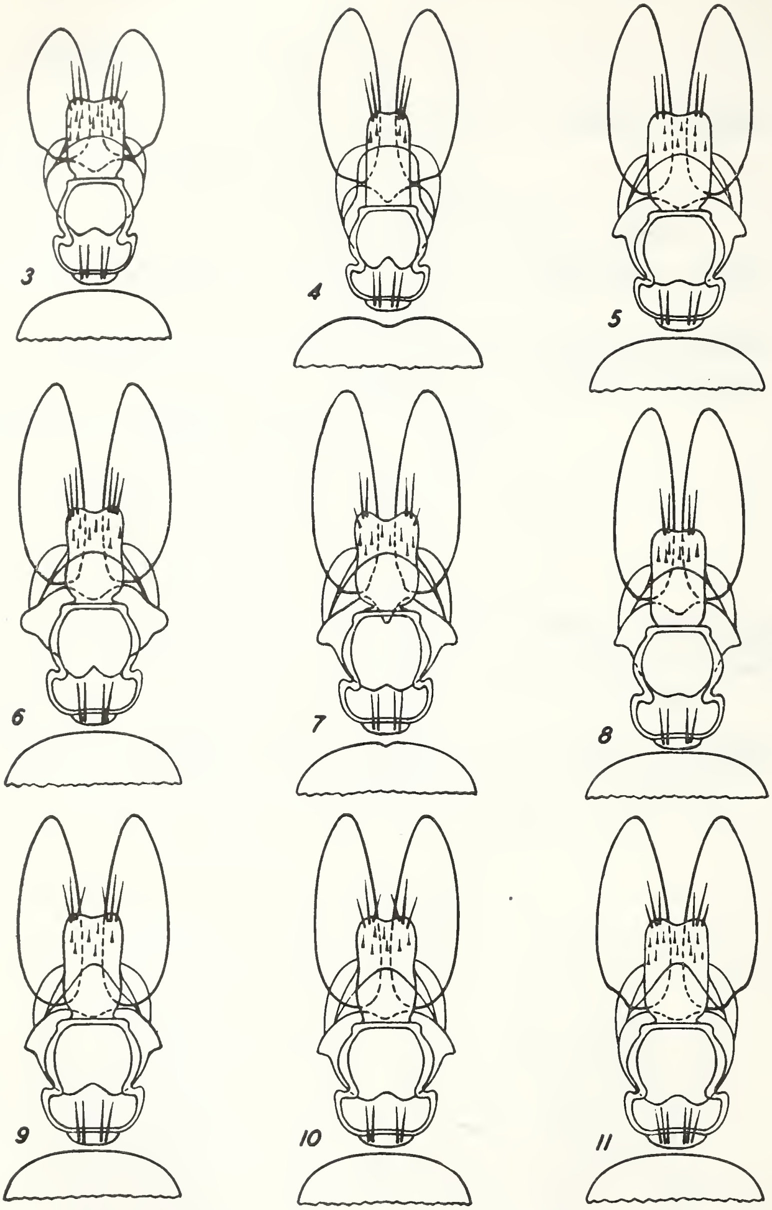
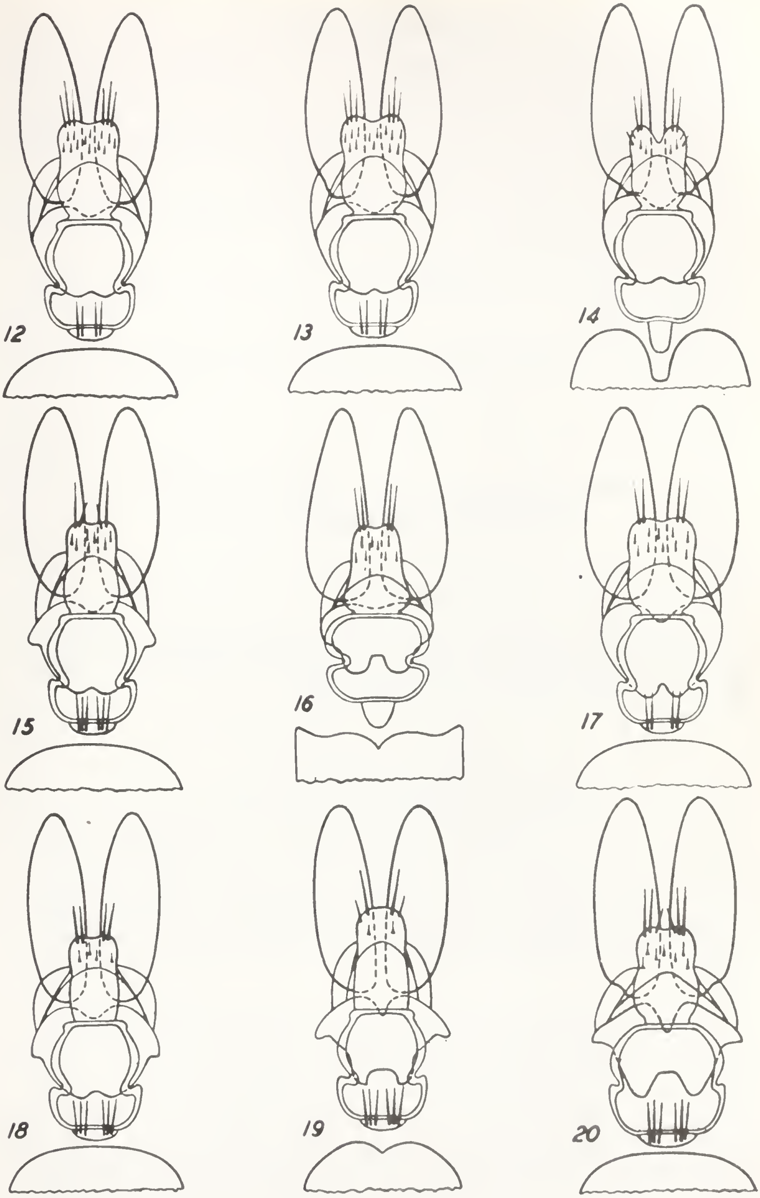
1. *Aedes dorsalis* (Meigen) 2. *Aedes squamiger* (Coquillett)



3. *Aedes varipalpus* (Coq.).
4. *Aedes taeniorhynchus* Wied.
5. *Aedes impiger* Walker.
6. *Aedes aboriginis* Dyar.
7. *Aedes aloponotum* Dyar.
8. *Aedes aldrichi* D. and Knab.
9. *Aedes communis* DeGeer.
10. *Aedes hexodontus* Dyar.
11. *Aedes flavescens* Müller.



12. *Aedes increpitus* Dyar.
13. *Aedes fitchii* (Felt and Young).
14. *Aedes vexans* (Meigen).
15. *Aedes ventrovittis* Dyar.
16. *Aedes cinereus* Meigen.
17. *Aedes cataphylla* Dyar.
18. *Aedes idahoensis* (Theobald).
19. *Aedes nigromaculis* (Ludlow).
20. *Aedes pullatus* (Coquillett).

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TWO NEW CHALCIDOID EGG PARASITES (EULOPHIDAE AND MYMARIDAE).

By A. B. Gahan,

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The following two new species of egg parasites are described at this time in order to make the names available for use in economic papers about to be published.

Family EULOPHIDAE.

Tetrastichus silvaticus, new species.

Closely resembles *Tetrastichus blepyri* Ashmead but the females may be distinguished from that species by the black scape, blackish tibiae, somewhat narrower abdomen, slightly weaker sculpturing of the mesoscutum, and presence of fewer (usually three) erect setae on the submarginal vein. The males differ by having much longer hairs on the funicle joints. The species is easily distinguished from *T. malacosomae* Girault by the black color and the shorter abdomen.

Female.—Length 1.2 mm. Black, somewhat shining, the sculpture of head, thorax, and abdomen weaker than in most species of the genus; antennae entirely black; front tibiae, narrow apical bands on middle and hind tibiae, and first three joints of all tarsi yellowish, rest of legs black; wings hyaline, venation brownish. Head (collapsed) weakly sculptured; scape rather short and slightly compressed; first funicle joint equal to the pedicel or slightly longer; second and third funicle joints subequal, longer than wide and each a little shorter than the first; club a little thicker than funicle, about equal in length to the two preceding joints combined; mesoscutum very finely and delicately sculptured, the median groove present but often very delicate; scutellum sculptured like mesoscutum,

the two dorsal grooves distinct; postscutellum nearly smooth; propodeum with some very obscure lineolation, practically smooth and shining, without folds but with a weak median carina, the spiracles elliptical; mesopleura and prepectus nearly smooth; coxae and femora nearly smooth; fore wings extending much beyond apex of abdomen, a little less than two and one-half times as long as broad; marginal vein much longer than submarginal and about three times as long as stigmal; postmarginal absent; stigmal vein slender and only very slightly thickened at apex; submarginal vein with three setae dorsally; marginal cilia about two-thirds as long as the stigmal vein; discal ciliation moderately long, and uniformly distributed except that the area behind the submarginal vein and a triangular area behind the proximal one-third of the marginal vein are bare, the two bare areas separated by a transverse row of cilia extending backward from the break in the submarginal vein; a straight row of cilia running nearly parallel to the posterior margin of the wing extends from the transverse row to a point on the posterior margin somewhat beyond the apex of the venation. Abdomen about as long as head and thorax, approximately twice as long as broad, ovate, subacute at apex, very weakly sculptured above as well as beneath; ovipositor not exserted.

Male.—Length 1.2 mm. Antennae long; scape slightly expanded beneath, approximately twice as long as broad, the ventral margin with a sense organ which forms an elongate and distinct swelling extending from a point near apex to about the middle of scape; funicle four-jointed, the first joint subquadrate, a little thicker than pedicel, and about equal to it in length; second funicle joint about twice as long as broad, third and fourth a little longer; club three-jointed, no thicker than the funicle and distinctly longer than the two preceding joints; each of the funicle and club joints with a whorl of very long coarse hairs, these hairs on the basal segments five or six times as long as the segment, on the club joints somewhat shorter, those on the apical joint about twice as long as the segment. Abdomen not longer than thorax, subelliptical, narrower than thorax. All coxae, the hind femora except at apex, and more or less of the middle and front femora basally black, rest of the legs yellowish; antennal pedicel yellowish. Otherwise like the female.

Type locality.—Cass Lake, Minn.

Type.—Cat. No. 52253, U. S. National Museum.

Described from three females (one holotype) and three males reared from eggs of *Malacosoma disstria* Hübner, February 11 to 26, 1936.

Besides the type series, the following additional material, now in the National Museum collection, has been identified as this species: 7 specimens from Chippewa National Forest, Minn., reared at the Forest Insect Laboratory of the Bureau of Entomology and Plant Quarantine, New Haven, Conn., under their No. 181.201 in February and March, 1936; also 13 specimens from Bristol and Randolph, Vt., reared February 20, 1937, under Forest Insect Laboratory No. 181.203; 5 specimens from Cook County, Minn., reared by L. W. Orr in December, 1936; and three specimens from Fredericton, New Brunswick, reared

June 11 and 12, 1934, by C. E. Atwood. The host in each case is said to have been *Malacosoma disstria.*

Family MYMARIDAE.

Erythmelus psallidis, new species.

This supposedly new species is extremely similar to (*Anaphes*) *Erythmelus gracilis* (Howard) and may eventually prove to be merely a form of that species. The large series of specimens at hand seems to differ constantly from the type of *gracilis,* however, by having the joints of the funicle very slightly shorter in proportion to their thickness, the fore wings smaller, and the basitarsi only very slightly longer than the second tarsal joint.

Female.—Length 0.45 to 0.65 mm. Black, the abdomen with a broad basal band pale yellowish, and the vertex laterad of ocelli more or less yellowish; antennae fusco-testaceous, the club blackish; legs fuscous, the knees and bases of all tibiae pale; wings hyaline.

Antennae about as long as head and thorax together; scape about as long as pedicel and first four joints of funicle combined, subfusiform, and about four times as long as broad; pedicel about twice as long as broad at apex; funicle joints 1 to 4 successively increasing very slightly in length as well as width, each a little longer than broad; joint 5 usually subquadrate; joint 6 nearly twice as long as broad; club distinctly thicker than the funicle, long-ovate, very nearly three times as long as broad and about equal in length to the preceding four funicle joints combined. Fore wing extending distinctly beyond apex of abdomen, more than four times as long as its greatest width (not including the marginal fringe); marginal fringe longer than greatest width of blade; discal cilia wholly absent from base of wing to apex of venation except for a single short black seta midway between anterior and posterior margins and about opposite base of marginal vein, beyond apex of venation and midway of length of wing the discal ciliation consisting of two longitudinal rows of weak cilia, and on apical third of wing the cilia much stronger and more numerous; hind wing narrow, the discal ciliation mostly confined to an irregular row along anterior margin. Basal joint of tarsi on all three pairs of legs not more than one-fourth longer than the following joint, often subequal to the second joint. Abdomen about as long as thorax, ovate, the hypopygium extending slightly beyond apex of apical tergite.

Male.—Length 0.4 to 0.55 mm. Agreeing with the female except as follows: Antennae as long as body, very slender, 13-jointed; scape short and thick, approximately twice as long as thick; pedicel about as long as broad; funicle joints subequal, and each three to four times as long as thick; abdomen one-half to two-thirds length of thorax; legs paler than in female, the anterior and median pairs frequently mostly testaceous.

Type locality.—Tallulah, La.
Type.—Cat. No. 52285, U. S. National Museum.

Holotype, allotype, and six paratypes reared from eggs of the cotton flea hopper, *Psallus seriatus* (Reuter), on croton plants at Tallulah, La., September 6 to 19, 1936, by H. J. Crawford. Other paratypes either reared from or associated with eggs of the same hemipteron are from Florence, S. C.; Starkville, Miss.; Waldo, Ark.; Bay City, Lincoln, Ingleside, Leona, Hearne, Gilmer, Glen Flora, Bryan, Fannin, Port Lavaca, Huntsville, Tyler, Rockport, Washington County, Montgomery County, Grimes County, and Brazoria County, Tex.; and Tucson, Ariz.

TWO TYPES OF MOTHPROOFING SOLUTIONS.

By E. A. Back,

U. S. Department of Agriculture, Bureau of Entomology and Plant Quarantine.

It is common knowledge that woolen fabrics are readily eaten by the larvae of clothes moths and carpet beetles. The latter are commonly known as buffalo moths, and for this reason the layman frequently refers to both of these insects as simply "moths." They are, of course, two entirely different types of insects; the clothes moth larvae being known as "moth pests," and the carpet beetle larvae as "dermestid pests," since carpet beetles belong to the family Dermestidae. Hence one often reads in trade journals of fabrics being treated with "mothicides" and "dermesticides" to render them resistant to the attacks of these insects. It is frequently claimed that a fabric treated with a "mothicide" may not be protected against dermestids.

In the course of investigations in the Bureau of Entomology and Plant Quarantine on the control of insects that destroy fabrics, the writer has, for the past 15 years, been interested in the use of moth-proofing solutions as a means of preventing damage. Among the many species that attack fabrics, special attention has been given to the webbing clothes moth (*Tineola bisselliella* Hum.), the furniture carpet beetle (*Anthrenus vorax* Waterh.), and the black carpet beetle (*Attagenus piceus* Oliv.), and many tests of various mothproofing solutions for protecting fabrics against these three insects have been made. Early investigations showed that in experimental work clothes moth larvae exhibited a high normal mortality which often led to a false interpretation of results. On the other hand, it was determined that the furniture carpet beetle, *Anthrenus vorax*, did not suffer such a high mortality; and furthermore, that fabrics resistant to carpet beetles were also protected against clothes moth larvae. In view of these findings, *Anthrenus vorax* has been used almost entirely in tests to determine the practical value of mothproofing solutions.

In recent years a number of arsenical mothproofing solutions have appeared on the market. These materials were accompanied by extensive advertising which stated in effect that such arsenical solutions gave positive protection to fabrics against moths, that one application was guaranteed to prevent moth damage for the life of the article treated, and that moth larvae could not possibly damage articles treated. One 1936 advertisement of an arsenical solution said to contain "active ingredient (sodium arsenite) ½ of 1%, inert ingredients 99½%" claimed that "one application to rugs, furniture, or clothing, when done properly according to directions, is sufficient to protect from further infestation of moth larvae and carpet beetles."

Early investigations relative to the efficacy of aqueous arsenical solutions for treating fabrics to render them moth resistant, led the writer to state that such solutions were of little value for this purpose. During 1936 further experiments were carried out with these solutions. One of these dealt with the solution referred to in the 1936 advertisement mentioned above. Samples of cloth treated by spraying and immersion in this solution as well as samples of the same cloth untreated were quickly ruined by the insects.

Twelve months after tests were started, both samples were so badly eaten that the treated pieces could not be distinguished from the untreated ones. The results with cloths secured from a private laboratory and a manufacturer were the same as those obtained with cloths treated in the testing laboratory of the Bureau of Entomology and Plant Quarantine. The results of these tests serve further to substantiate the earlier statements of the writer that aqueous arsenical solutions are of doubtful value as mothproofing agents.

Another series of experiments with mothproofing materials carried out by the Bureau of Entomology and Plant Quarantine during the past two years is of special interest. In cooperation with the War Department in testing army suitings, samples of untreated cloth and some that had been treated with a penta-chloro-dioxy-triphenal-methane-sulphonic acid solution applied in the hot dye bath to the extent of 2 per cent by weight of the chemical to the weight of the dry woolen goods were tested. Samples of the treated cloth, one group of which had been dry-cleaned six times, one that had been washed in water and a neutral soap six times, one that had been washed in water and caustic soap six times, and two that had been weather-tested 10 and 30 days, respectively, were also tested. After about five months, during which time each sample or combination of samples had been exposed to about 50 larvae of *Anthrenus vorax*, the original treated cloth and the treated cloths that had been dry-cleaned, water-washed, and weather-tested showed no appreciable injury (plates 28 and 29); the treated samples that

had been washed in water and caustic soap showed slight injury in spots (plate 1, upper left circle), but nowhere was the warp affected. In all of the check or untreated samples (plates 30 and 31) the pile and warp were badly damaged, with large holes developing.

An examination of the insects in the tests, made over three months after they had been placed on the cloths, showed that 41, 29, 25, 28, 21, and 33 larvae on cloths 1A to 6A, respectively (plate 28), were dead; that 7, 9, 15, 12, 15, and 7 larvae had pupated and died, while 9, 13, 10, 11, 11, and 11 larvae had become adults that had laid many eggs, all of which had hatched into larvae which in turn died without apparent feeding. One sickly abnormal larva was found alive on each of cloths 2A, 3A, 4A, and 5A, and seemed to have been eking out an existence upon the dead bodies of larvae.

An examination of the check, untreated, cloths of plate 30 showed that 10, 12, 11, 9, 10 and 15 larvae on cloths 1A to 6A, respectively, were alive and very thrifty looking; that 8, 2, 3, 5, 17, and 10 had died; that 1, 1, 3, 8, 3, and 6 had pupated and were alive except 2, and that 25, 27, 19, 21, 13, and 20 had matured to adults that had laid many eggs, all of which had hatched into larvae still newly hatched but very much alive and feeding.

The difference in the reaction of the newly hatched larvae to the cloths treated with the pentachloro-dioxy-triphenal-methane-sulphonic-acid solution is of great practical importance, especially when considered along with the inability of the more mature larvae, placed originally on the treated cloths, to cause injury.

Of two pieces of army suiting, each about 3 feet square, kept from January to December, 1937, in the laboratory in an open closet where insects had access to them, all injury was confined to the untreated fabric, while that treated with a pentachloro-dioxy-triphenal-methane-sulphonic-acid solution escaped unharmed.

It would seem from these and tests of other fabrics also treated with the same solution that six washings in a mild soap-water solution, six dry cleanings, and weather testing for 10 and 30 days had no appreciable effect upon the protection imparted but that six washings in caustic soap and water, a treatment never followed in handling woolen goods in the Quartermaster Department of the Army, did weaken the protection sufficiently to permit some slight and observable feeding on the nap only (plate 1, upper left circle).

The cloths shown in plates 28 to 31 were cut into circles approximately $3\frac{1}{2}$ inches in diameter to fit easily into glass petri dishes before the *Anthrenus vorax* larvae were placed on them. Being confined with a single piece of cloth in plates 1 and 3, the insects

had no choice but to react to that particular piece of cloth. In plates 29 and 31, however, the cloths were cut into half circles which were matched with one receiving the same or other treatment and the amount of feeding is considered an index to any preference the larvae may have for one or the other of the cloths. While in plates 28 and 29 all the cloths originally were treated with the pentachloro-dioxy-triphenal-methane-sulphonic-acid solution, and in plates 30 and 31 all the cloths were untreated, the left-hand half circles in plates 29 and 31 were given certain manipulations (except 1 and 1A (plate 29) and 1 and check (plate 31)) such as washing, dry cleaning, or weather testing.

In plate 32 are shown comparisons between treated and untreated material from woolen blankets taken from experiments that gave the same excellent protection when 2 per cent of the pentachloro-dioxy-triphenal-methane-sulphonic-acid solution is used in a hot dye bath; the lower treated fabric had been sold with a guarantee that if ever moths caused injury to it a new blanket would be furnished free.

EXPLANATION OF PLATES.

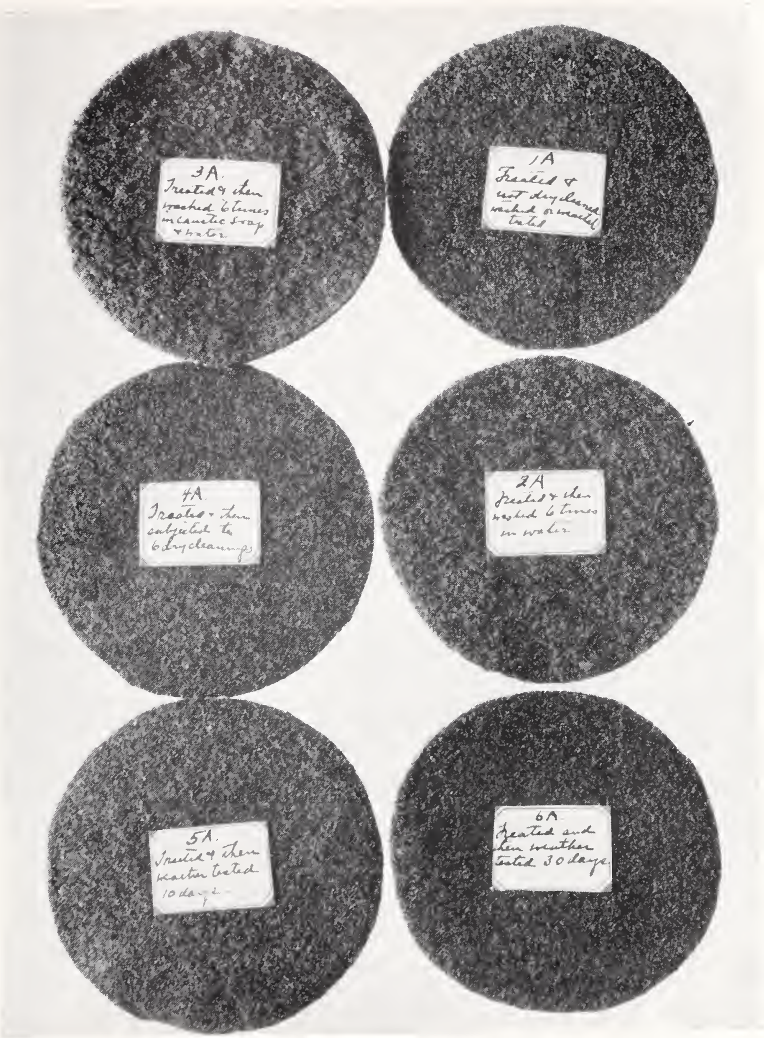
PLATE 28. Whole circle army cloth treated with a pentachloro-dioxy-triphenal-methane-sulphonic-acid solution: 1A, received no subsequent treatment; 2A, washed six times in neutral soap and water; 3A, washed 6 times in caustic soap and water; 4A, dry cleaned six times; 5A, weather tested 10 days; 6A, weather tested 30 days. Each cloth subjected to attack of about 50 well grown larvae of *Anthrenus vorax* and photographed three months thereafter.

PLATE 29. Cloths all mothproofed as those in plate 28; and the 1A to 6A half circles subsequently treated as 1A to 6A cloths of plate 28, but matched with half circles (unclipped) receiving no washing, dry cleaning or weather testing. Each set subjected to attack of about 50 well-grown larvae of *Anthrenus vorax* and photographed three months thereafter.

PLATE 30. Same cloth as shown in plate 28, but not mothproofed: 1, untreated; 2, washed six times in neutral soap and water; 3, washed six times with caustic soap and water; 4, dry cleaned six times; 5, weather tested 10 days; 6, weather tested 30 days. Each cloth subjected to attack of about 50 well-grown larvae of *Anthrenus vorax*, and photographed three months thereafter.

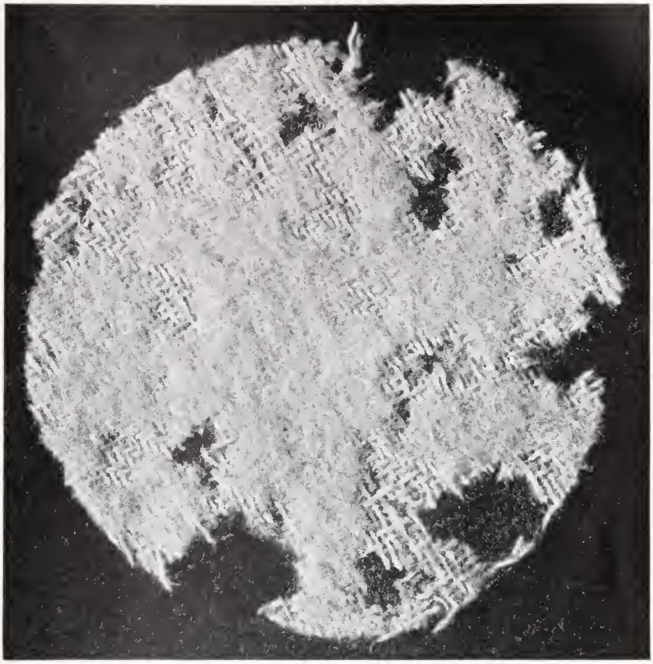
PLATE 31. All cloths untreated, as were those of plate 30, but half circles at left receiving following manipulations: 1, no treatment same as cloth on the right; 2, washed six times in neutral soap and water; 3, washed six times in caustic soap and water; 4, dry cleaned 6 times; 5, weather tested 10 days; 6, weather tested 30 days. Each cloth subjected to about 50 well-grown larvae of *Anthrenus vorax*, and photographed three months thereafter.

PLATE 32. Wool blanketing subjected to about 50 larvae of *Anthrenus vorax* and photographed after three months: upper fabric untreated, lower fabric treated in the hot dye bath with a pentachloro-dioxy-triphenal-methane-sulphonic-acid solution.


3A.
Treated & then washed 6 times in caustic soap & water
1A
Treated & not drycleaned washed or weather tested
4A.
Treated & then subjected to 6 drycleanings
2A
Treated & then washed 6 times in water
5A.
Treated & then weather tested 10 days
6A
Treated and then weather tested 30 days.


2
untreated,
after 6 washings
in water
4
untreated
after six
drycleanings
5
untreated,
weather tested
6
untreated,
weather tested
30 days


1 + Check
Both untreated
both with no
subsequent after
2 + Check.
Both untreated
2 subjected to
3 + Check.
Both untreated
3 subjected to
6 washings in water
and caustic soap
4 + Check.
Both untreated
4 subjected to
6 dry cleanings.
5 + check
Both untreated
5 - weather
6 + check
Both untreated
6 weather tested
30 days



FLY DAMAGE TO DRYING CUT FRUITS.

By Heber C. Donohoe,
Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

In June, 1935, the writer investigated reports of infestation of drying apricots by flies in the northern Sacramento Valley of California. The condition in certain drying yards was severe, instances being observed in which flies were so numerous as wholly to cover many apricot halves. The species involved were determined by D. G. Hall of the Division of Insect Identification, Bureau of Entomology and Plant Quarantine, as *Musca domestica* L., *Lucilia caeruleiviridis* Macq., *Lucilia sericata* Meig., and *Cryptolucilia caesarion* Meig.

The flies congregated in the cutting and drying yards, swarming around and on the cutters and on the moist fruit as soon as it was cut and laid on the trays, and again as soon as the sulphured apricots were spread in the drying yard. During sulphuring the cups of the apricot halves become well filled with juice, making the fruit especially attractive to the flies as soon as it is spread for drying.

While considerable loss in weight of the fruit occurred through the feeding of the flies on the juice in the cups, the chief damage was caused by deposits of excreta. The excreta deposited on moist pieces mixed with the juice in the cup of the fruit and became indistinguishable from it. With evaporation of the liquid in the cup and the formation of a film over the fruit, these deposits were evident as spots on the surface. As many as 141 of these flyspecks were counted on a single apricot half. There was also a less obvious pollution, in the form of regurgitated droplets. Examined for halves showing 5 or more apparent flyspecks per piece, a sample of apricots from one heavily infested yard showed 77 per cent contamination and that from another, 92.6 per cent.

The flies were most plentiful about drying yards where dairy barns and horse stables were near at hand. In several yards visited which were remote from such locations flies were either very scarce or lacking, and no contamination of the fruit was apparent. During midseason one grower, whose drying yard adjoined a stable and an insanitary barnyard and showed a greater abundance of flies than was encountered elsewhere, moved the drying yard to a spot in his orchard about one-half mile from the nearest stable. At the time the writer visited this new yard, during peach drying, not more than a dozen flies were noted, and the owner reported complete freedom from this annoyance immediately after he had moved from the original location.

Observations made during peach drying in August showed that conditions were the same as those encountered with drying apricots in June except that after two additional months of very warm weather, fly abundance in general was much reduced.

MINUTES OF THE 486th REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

The 486th meeting of the Society was held at 8 P. M., Thursday, November 4, 1937, in Room 43 of the National Museum, with forty-nine members and eleven visitors present and N. E. McIndoo presiding. The minutes of the previous meeting were read and approved.

The chair announced the appointment of the Nominating Committee, consisting of Austin H. Clark (chairman), C. E. Burnside, Alan Stone, J. S. Wade and W. B. Wood.

In the absence of the chairman of the Membership Committee, the recording secretary read the names of the following: W. H. Anderson, J. M. Brennan, C. M. Packard, J. G. Rempel, R. C. Roark, L. W. Saylor, M. R. Smith and Miss Margaret Walton, who upon recommendation by the Executive Committee were unanimously elected to the Society.

The first paper on the regular program, entitled "Observations on gladiolus thrips," was given by R. H. Nelson. Since this paper is to be published elsewhere, no abstract is included here. It was discussed by H. L. Dozier and F. F. Smith.

M. R. Smith presented the second paper, entitled "The Argentine Ant and its Control." Dr. L. O. Howard added some very interesting notes on this subject.

[Although the Argentine Ant entered the United States some time slightly previous to 1890, it is now known to occupy approximately 4,000 square miles in 13 States. The heaviest infestations are in the Gulf Coast States and California. The species has been spread mainly by overflows and by commerce. In the region in which it occurs the Argentine ant is the worst hluse infesting ant that we have. The success of the species is attributed to (1) the ant's ability to produce prodigious numbers, (2) its lack of many natural enemies, and (3) its omnivorous feeding habits.

[The Mississippi State Plant Board in cooperation with various towns and counties in Mississippi has demonstrated that the ants can not only be controlled but even eradicated through the use of the Government formula Argentine Ant poison. The success of the campaigns is dependent, however, on such factors as the proper season for distributing the poison, the thoroughness of the work, and the protection of the cups after they have been distributed.

[The cost of a campaign amounts to approximately 2 to 3 cents per cup of poison or about three to four and one-half dollars per block per year.] (Author's abstract.)

Following the second paper a brief discussion of the control by submergence of the sweet potato root weevil was given by H. L. Dozier.

The meeting adjourned at 9.30 P. M.

CATHERINE FORD,
Recording Secretary.

Actual date of publication, December 30, 1937.

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ANNOUNCEMENT

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